ELECTRICAL TIMES

The sign of a Nation-Wide Service

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E.C.C. CANADA LIMITED, TORONTO. ● E.C.C. SOUTH AFRICA PTY. LIMITED, VEREENIGING. ● E.C.C. TRANSFORMERS & CONTROLS LTD., LOWER HUTT, NEW ZEALAND. ● McCOLL ELECTRIC WORKS LTD., AUSTRALIA.

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...from top to bottom

most modern electric cookers have

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Europe's Leading Heating Element Specialists

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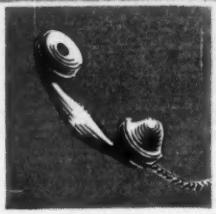
are all available from our stock, which includes a comprehensive E.D.A. range... or quickly tailored to your own specification.



At Backer we are specialists in Tubular Sheathed Heating Elements. And our technical organisation is geared for prompt attention to your enquiries. We are at the end of your telephone line.

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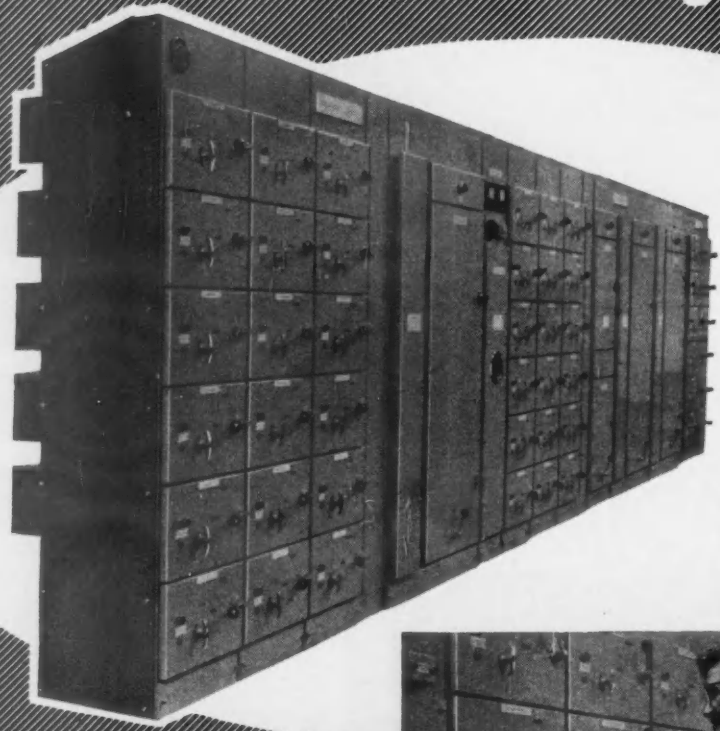

SIX·TIER MOTOR STARTER UNIT

Designed to meet the need for accommodating a large number of Starters in a small space with a consequent saving in building costs but without sacrificing any protective features.

"Wecol" Equipment is widely used throughout Industry at home and abroad. There is a comprehensive range of equipment designed to meet all operational requirements including Flameproof Equipment for hazardous atmospheres. Informative literature is available on request and "Wecol" Engineers will be pleased to discuss and advise on your own particular requirements.

The chassis carrying all components except the individual isolator may be withdrawn for routine inspection and maintenance simply by turning the lockable cover handle when the isolator is "Off".

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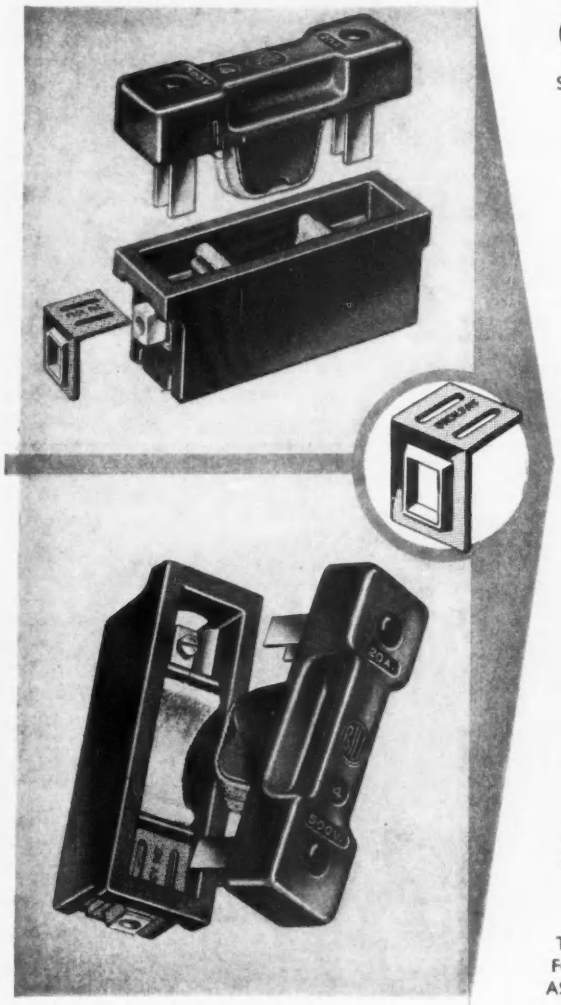
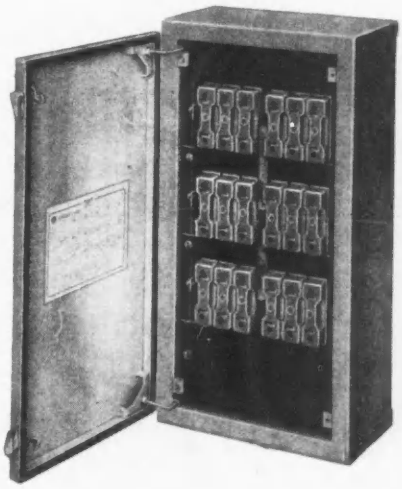
SAFETY BILL SHIELDS



BILL ARC DAMPING TYPE OR H.R.C. DISTRIBUTION FUSEBOARDS ARE NOW FITTED WITH THE BILL SAFETY SHIELDS (PROV. PAT.) AS ILLUSTRATED.

FUSEBOARDS ARE AVAILABLE WITH NO PRICE INCREASE IN ALL SIZES OF 15/20 AMP. AND 30 AMP. RATINGS.



THE INTRODUCTION OF PROTECTIVE SHIELDS FITTED OVER THE LIVE CONTACT ENDS IN THE FUSE BASES GIVES ADEQUATE PROTECTION AGAINST ACCIDENTAL CONTACT WHEN THE FUSE CARRIERS ARE WITHDRAWN.

THE SHIELDS ARE STRONG DURABLE MOULDED NYLON AND FORM AN INTEGRAL PART OF THE BUSBAR FUSE CONTACT ASSEMBLY AND CANNOT ACCIDENTALLY BECOME DETACHED.

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the original continuously-adjustable autotransformer

with the Exclusive

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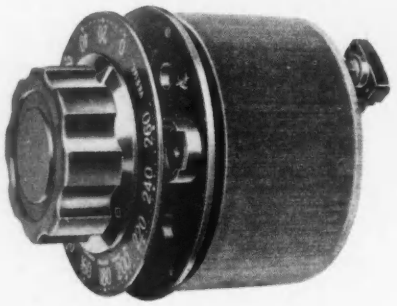
Contact Surface

A small model with the qualities of the larger sizes. Available at an economic price allowing its frequent use for voltage control down to zero in conjunction with heaters and other apparatus having loadings up to 270 vA at 240 volts.

The usual over-voltage feature is standard giving 0-270 volts at 1 ampere.

It is suitable for bench or panel mounting, and is also offered as an enclosed type ('V3HM'), ganged, motorised, and in other style variations.

Our Catalogue VAR-5 gives details on page 4 and includes over 300 other models. Has a copy reached you?



Model 'V3H'
270 vA
Input 240v 50 cycles
Output 0-270v 1 ampere

THE ZENITH ELECTRIC COMPANY LTD.

ZENITH WORKS VILLIERS ROAD WILLESDEN GREEN LONDON N.W.2

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streamlite

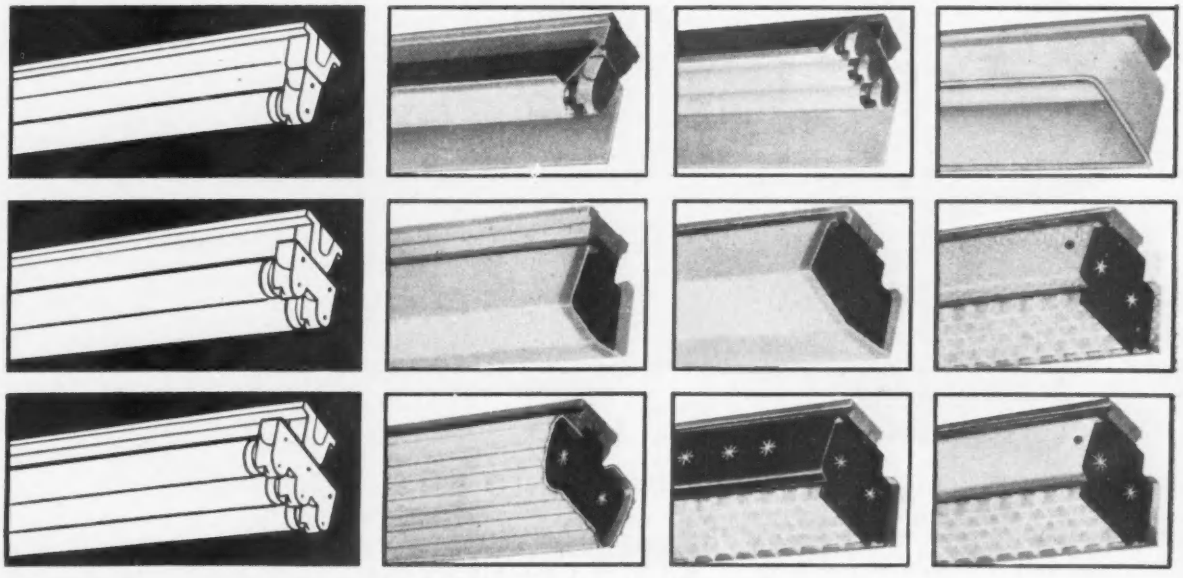
is here!

The newest, slimmest lighting fittings for 1, 2 and 3 lamps 5ft. 80w (1 & 2 lamps 2ft. 20w, 4ft. 40w) — with a big range of reflector and diffuser attachments

Philips Streamlite – it's the newest thing in fluorescent lighting fittings. And it outdates every other type of fitting on the market. For Philips Streamlite – so slim, so sleek, so stylish – has far more to offer than any other fluorescent fittings you can buy, including some advantages that are as unique as they are striking:

- *Philips Streamlite gives you Switch and Switchless start in the popular sizes.*
- *There is a choice of one, two or three lamp fittings – all equipped with Philips even slimmer Polyster ballasts.*
- *There is a fine range of diffusers and reflectors.*
- *It is extraordinarily reasonable in price.*
- *B.S. Box fixing and conduit entries at 24″ centres. (B.S. 2467)* 2 ft. 20w. 17½″ centres.
- *Variable fixing centres for B.S. Boxes where used with slide-grip hangers.*
- *For single and continuous mounting.*
- *Philips Sprung Rotor lampholders with earth plungers for lamp end-caps – rapid fixing, automatic positioning.*
- *10 amp. mains terminal block, and earth connection.*
- *Full length back plate with rigidly secured cast alloy ends providing earth continuity for end-entry conduit.*
- *Easily removed plastic inserts for end-conduit entries.*
- *Cable way for through wiring: cable cleats provided.*

They'll be in big demand – order now!



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This range of automatic star-delta starters is suitable for controlling motors up to 55 h.p. on 380/440 volts, three-phase supply, and utilised in their construction are our now famous heavy duty contactors, which are fitted with solid silver contacts, air-break; the solenoid assembly only is oil-immersed, but NO MAINTENANCE IS REQUIRED. This unique design prevents contact bounce by controlling the speed of the contact make and break, thereby increasing the contact life considerably. No other contactor has this feature.

The Illustration shows Automatic Star-Delta Starter with built-on isolator and flush mounting push button station with selector switch.

POST THIS COUPON TO-DAY!

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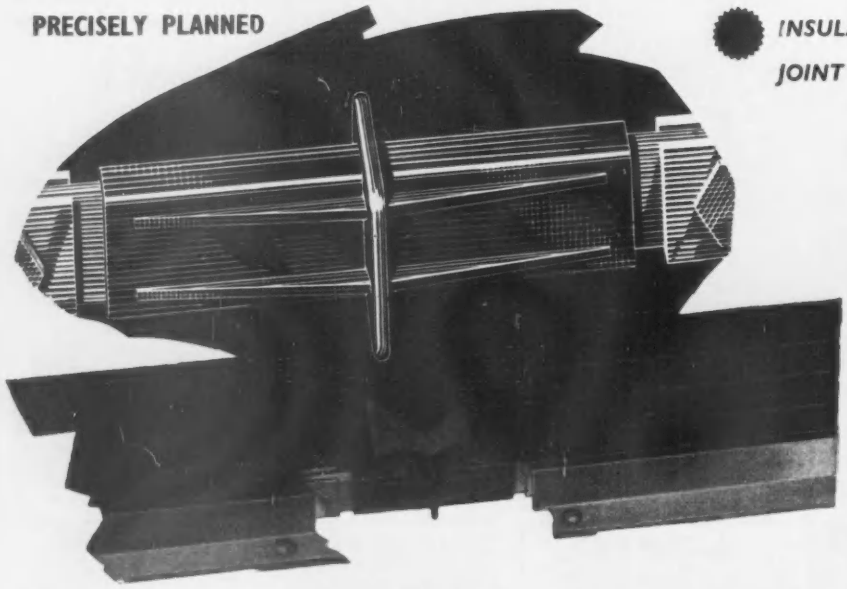
PRECISELY PLANNED

INSULATED JOINT SLEEVE



The small cross section of Barduct giving both practical and technical advantages is made possible by separating the phase conductors by continuous barriers of high-grade extruded insulation. To maintain this standard at joints between successive lengths, moulded joint sleeves are fitted to each bar as illustrated. They provide a creepage distance to earth of 2", and a phase to phase creepage of 4". The flanged centre of the sleeve ensures that the insulation is always positioned where it is needed at the joint, and also provides an effective support for the conductors when the Barduct is positioned vertically for a rising main. A limited amount of endwise movement is allowed, to permit the bars to expand due to temperature variation.

. . . BARDUCT IS *PLANNED* WITH PRECISION

Barduct system is specially designed for distributing electric power to individually driven machines. Connection being made by means of fused plug-in tappings, rated at 20, 30, 60 or 100 amps.

Barduct trunking is 5½" wide and less than 2" deep and rated at either 150 amp or 250 amp per phase. Each conductor is enclosed and separated from the other throughout its length in high grade insulation, giving extreme reliability.

BARDUCT

designed and manufactured by

MARRYAT & PLACE LTD

40, HATTON GARDEN, LONDON, E.C.1 *Telephone: HOLborn 8181*

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this booklet means business ...for YOU!

Every factory employing 20 or more is required by the Factory Act to provide means of giving audible warning (throughout the building) in case of fire.

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BOXES AND CLAMPS FOR M.I.C.C. CABLE

CABLE CLAMPS

Cable clamps are suitable for single or twin-core mineral insulated copper covered cable 0.0015 to 0.003 cross-sectional area.

List No. 901—single entry cable clamp.

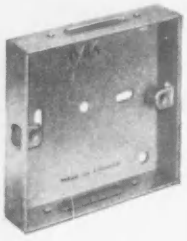
List No. 902—double entry cable clamp.

MK have introduced a new range of boxes and clamps for MICC cable. Single or double entry clamps are interchangeable with any of the boxes and are supplied separately with fixing screws and shakeproof washers. Steel boxes and cable clamps are zinc plated.

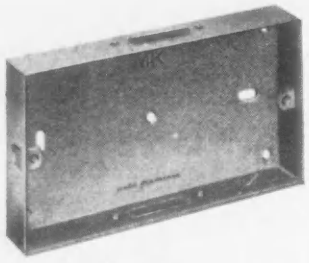
WRITE FOR LEAFLET 257

PLASTER-DEPTH BOXES FOR M.I.C.C. CABLE

These boxes have one clear entry and one knockout for attaching either single or double entry cable clamps.



List No. 3951—Plaster-depth box with $2\frac{3}{8}$" fixing centres.

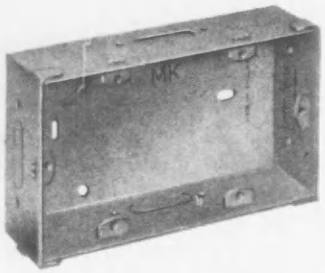


List No. 3952—Plaster-depth box with $4\frac{3}{4}$" fixing centres.

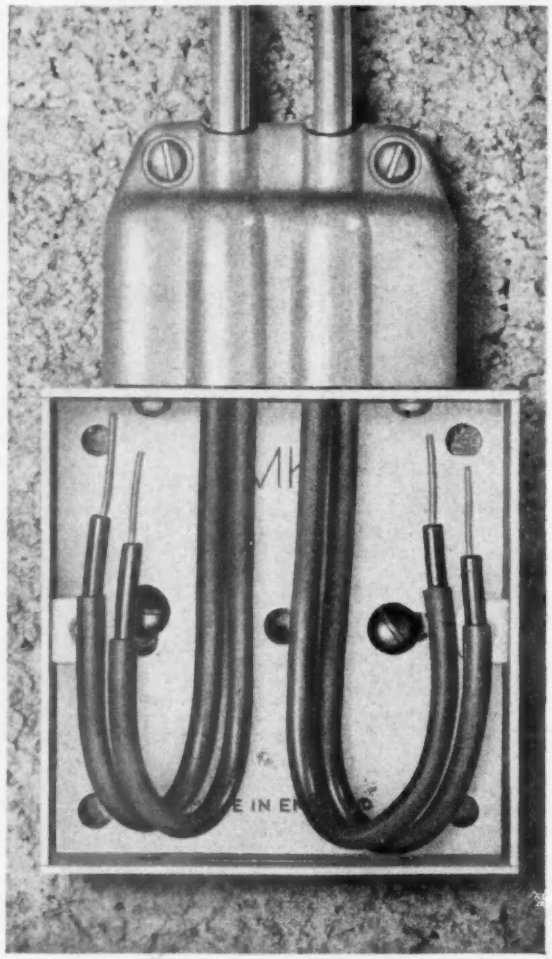
DEEP BOXES FOR M.I.C.C. CABLE

Deep boxes have one clear entry on one side and one knockout on each of the other three sides and one in the back to which can be attached a single or double entry cable clamp.

List No. 881—Box to BS 1299/1363 dimensions having $2\frac{3}{8}$" fixing centres.



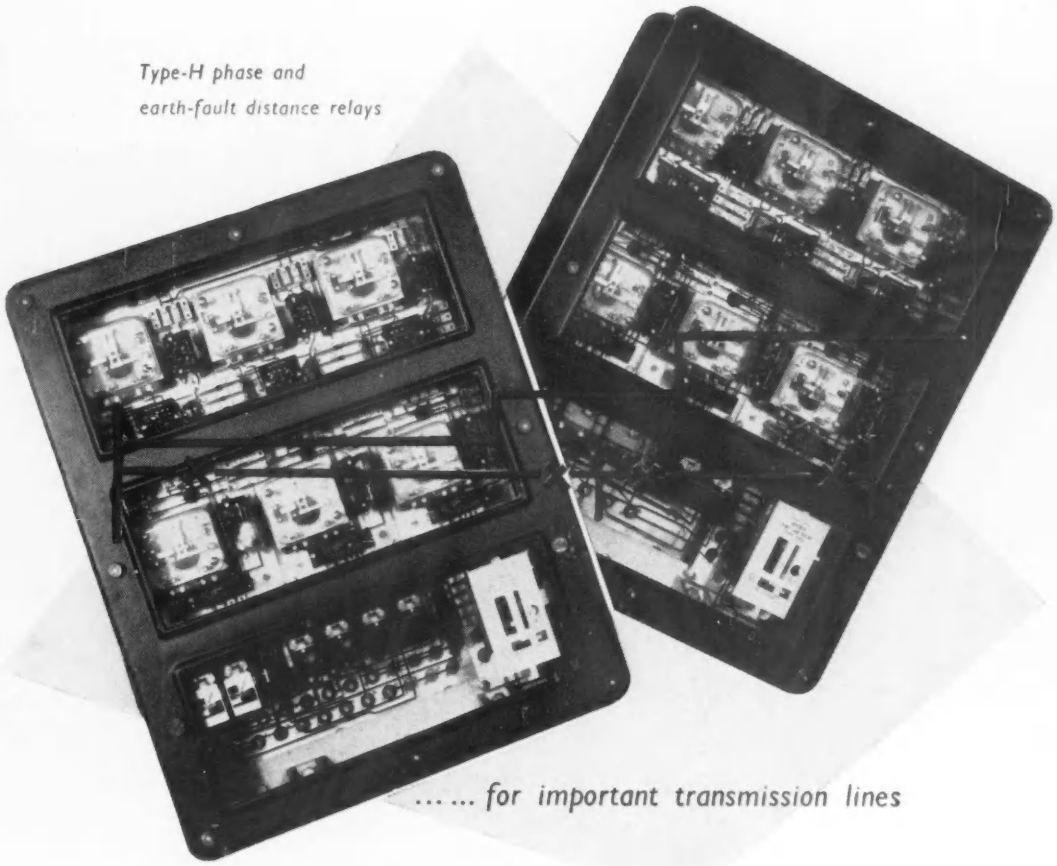
List No. 882—Box to accommodate any two gang MK accessory.



M.K. ELECTRIC LIMITED, SHRUBBERY ROAD, LONDON, N.9. EDMONTON 5151

MK197DHB

Type-H phase and earth-fault distance relays



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DISTANCE-PROTECTION

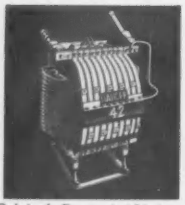
Reyrolle type-H high-performance distance protection incorporates the following important features:

- High speed for all types of fault
- Accurate measurement for exceptionally wide range of source to line impedance
- Negligible over-reach on D.C. transients
- Separate moving-coil elements for earth-faults and phase-faults
- All relay-elements identical and easily removable
- Self-contained design reduces panel wiring
- Built-in phase-selectors for single-phase auto-reclosing if required

Ask for Pamphlet 1297

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND



Original Ferranti 150 h.p. 10,000/2,500-volt, air-cooled transformer of 1888.

70 years of FERRANTI leadership in the transformer field

1888 First 10,000 volts power transformers, designed, built and installed by the late Dr. S. Z. de Ferranti.

1921 First order received in Great Britain for 110,000 volt transformers - 12,000 kVA three phase banks for New Zealand.

1924 Forced oil circulation through windings arranged for directed oil flow introduced in 30,000 kVA, 120,000 volt 3 phase transformers for India.

1927 Largely due to the efforts of Ferranti Ltd., three phase transformers adopted as standard by Central Electricity Board for British Grid System.

1929 First 20,000 kVA, 132,000 volt, 3 phase transformer impulse tested up to 900 kV and put into service on the British Grid System.

1931 75,000 kVA, 132,000 volt transformers successfully transported in service tank within railway loading gauge.

1933 60,000 kVA, 132,000 volt transformer impulse tested up to 1,000 kV.

1935 Short circuit tests to destruction carried out on a fully assembled 80,000 kVA, 66,000 volt, 3 phase transformer.

1946 First order received in Great Britain for 230,000 volt transformers - 64,000 kVA, 3 phase, fully insulated units for Finland.

1949 New Transformer Factory - one of the most modern in Europe - commenced production.

1951 First order received in Great Britain for 300,000 volt transformers - 71,000 kVA single phase units for Canada.

1955 4,000,000 volt Impulse Generator - the largest in Europe - designed and built by Ferranti engineers installed in the Ferranti Testing Laboratories at Hollinwood.

1956 First order received in Great Britain for 330,000 volt, 3 phase transformers - 120,000 kVA Auto Transformers and 60,000 kVA double wound transformers for Kariba Hydro Electric Scheme.

1957 Largest overseas transformer contract ever placed with a British manufacturer - 180,000 kVA, 240,000 volt and 180,000 kVA, 120,000 volt, 3 phase Transformers for Niagara Power Project.

1959 First order placed by Central Electricity Generating Board for 310,000 kVA, 306,000 volt Transformers.

1960 First order placed by Central Electricity Generating Board for 400,000 kVA, 380,000 volt Transformers.

FERRANTI

FIRST INTO THE FUTURE

The name of Ferranti is synonymous with the beginning of the manufacture and use of power transformers and, through the years, has been associated with many important advances in transformer design.

History shows that throughout the development of power transformers, Ferranti Ltd. have been amongst the first to equip themselves to meet the latest demands in capacity and voltage and their aim is to continue this tradition as builders of fine transformers.

FERRANTI LTD · HOLLINWOOD · LANCASHIRE

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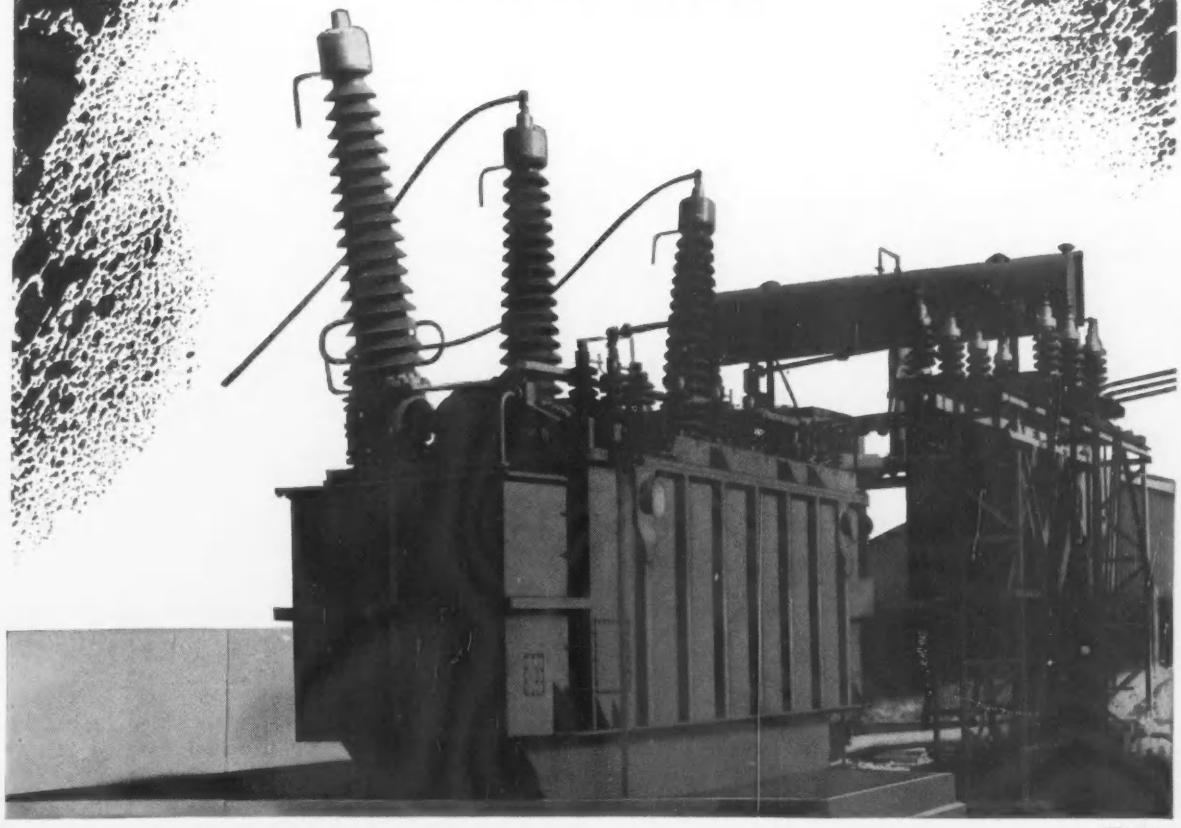
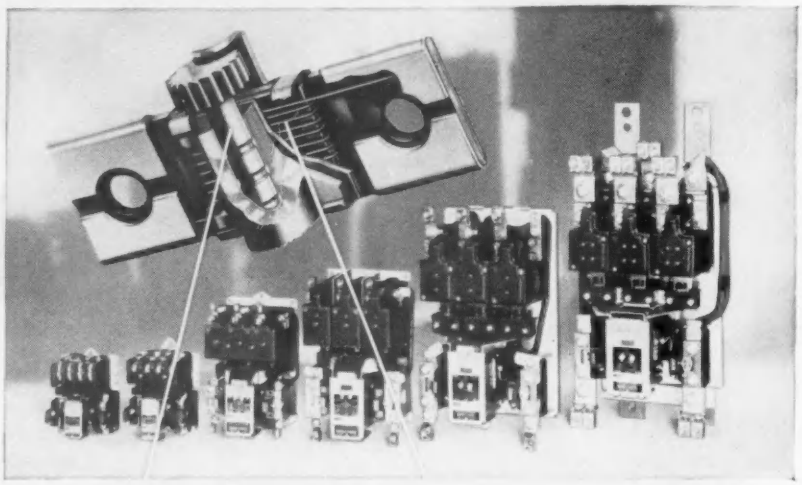


FT 253/3

When you buy Motor Starters - -

YOU PAY FOR OVERLOAD PROTECTION

BE SURE YOU GET IT!



Heat-responsive element *(solder pot) provides accurate response to overload, yet prevents nuisance tripping.*

Heat producing element *is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.*

Only ONE-PIECE Overload Relays can give 100% Protection.

Only with ONE-PIECE construction can you *know* you've installed the heater correctly. Only with ONE-PIECE construction can you *know* the heater is exactly centred, or properly positioned, so that it performs according to its rating. Only with ONE-PIECE construction can you *know* your starters will not operate without the thermal units properly installed. Only with ONE-PIECE construction can you *know* your motors have full protection.

Only Square D has ONE-PIECE Construction. ONE-PIECE construction eliminates any possibility of heater misalignment. Square D melting alloy thermal overload relays can be installed only one way. They are tamper-proof. They are factory-assembled, are individually calibrated and tested. Repeated tripping will not affect their accuracy.

Insist on square D starters with melting alloy thermal overload relays

LET US PROVE IT!

Let your Square D Field Engineer show you **1** how one-piece construction is accomplished and how easy it is to mismatch separate heaters and solder pots — **2** a tripping time tester to compare various types of melting alloy units and to prove that tripping time won't change after repeated operation.

LEADERS IN CONTROL GEAR FOR OVER 50 YEARS.

EC & M Heavy Industry Electrical Equipment . . . Now a part of the Square D line

To have the best *Specify* Square D

SQUARE D LIMITED

CHENEY MANOR SWINDON WILTSHIRE

Square D products are stocked by leading electrical wholesalers throughout Great Britain.

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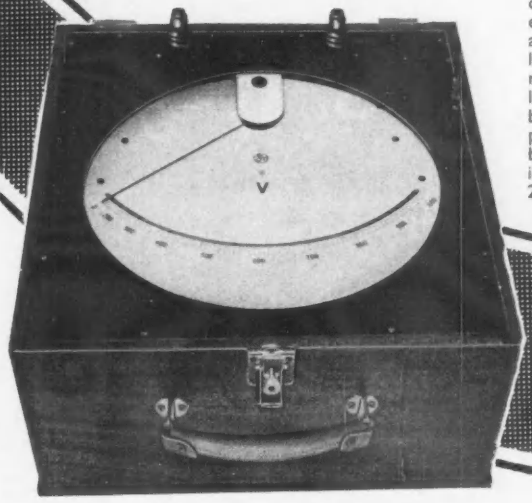
HA23

Offer Something NEW!—the Portable
ELECTROSTATIC VOLTMETER

With a guarantee of overall excellence



In producing this top grade accurate instrument NALDERS have overcome the common deficiencies recognised for electrostatic instruments and have achieved first class damping—remarkably low pivot friction and high torque/weight ratio.
It indicates readings with an accuracy better than ±0·3. The instrument is completely screened to eliminate interference by external electro-magnetic fields. The input resistance is extremely high—nearly 20 million megohms.
Full details are Post Free.

12″ PORTABLE 1000 Volts

A first grade commercial instrument

CERTIFICATED after test by The British Scientific Instrument Research Association

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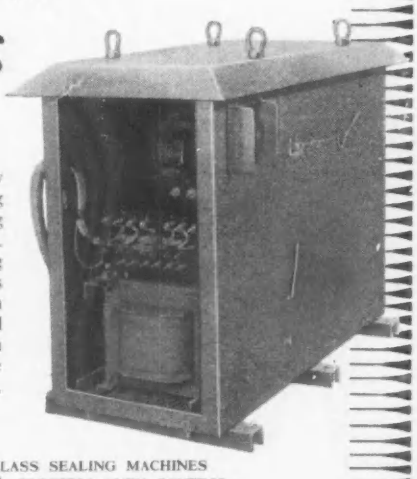
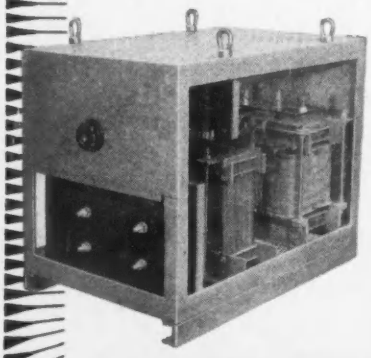
HED

ON LOAD STEPLESS CONTROL SATURABLE REACTORS





A Saturable Reactor is an infinitely variable A.C. choke. It has no moving parts, control being effected by forcing a D.C. magnetic field through the A.C. magnetic circuit, the D.C. field being controlled by a small resistance. This resistance can be remote from the main reactor, making a very convenient control and, should space be a vital factor on the site, the Reactor itself may also be placed at some other convenient position.

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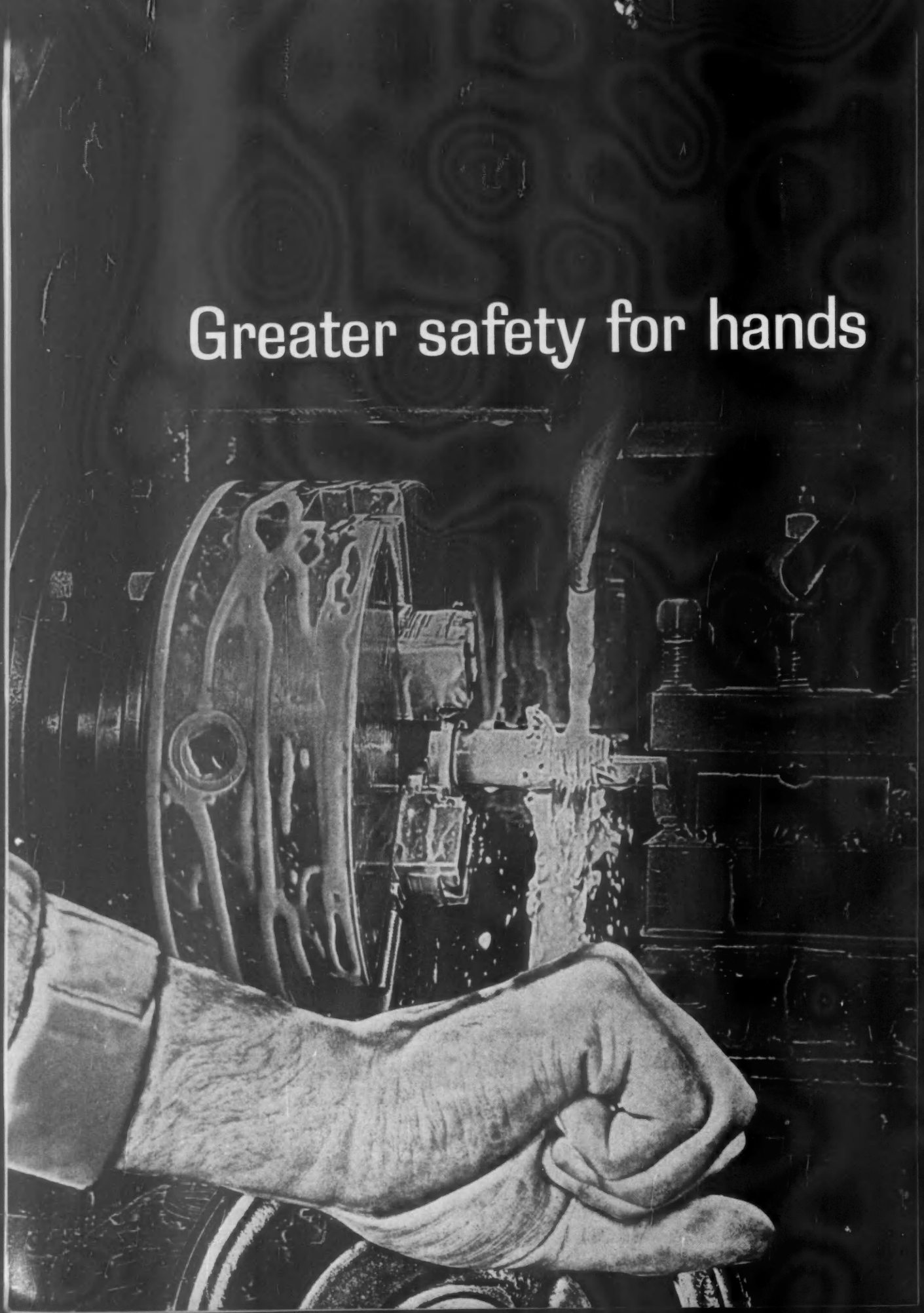
HIRST ELECTRONIC LTD GATWICK RD · CRAWLEY SUSSEX

Greater safety for hands



With new Shell Dromus Oils

Most modern soluble cutting oils contain phenolic compounds used as coupling agents between the oil and the emulsifier, for better blending and easier mixing. These phenolic compounds can cause skin irritation, especially where modern high-speed machines are used and the emulsion can concentrate, through the evaporation of water, above the safety level.

Shell research chemists have been working on this problem, which has been causing some concern to Management. After considerable research, Shell Dromus Oils have been reformulated and these new cutting oils now produce bland emulsions, which considerably reduce the risk of skin trouble to operators.

The real difficulty was to find a new coupling agent to replace the phenolic compounds, and Shell finally used what their chemists know as a higher fatty alcohol complex. This solved one problem, but presented another. The new coupling agent was volatile at the high temperatures normally used in blending processes. Further research found a solution to this problem by designing and installing new plant.

The new Dromus Oils are every bit as efficient as before and cost no more. They put Management in the welcome position of being able to minimise working hazards at no extra cost. And machine men need no longer be so worried about skin troubles.

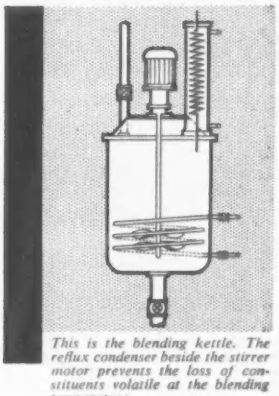
The moral of the story is that Shell research is supremely applicational. The centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organization have any major lubricating problems, it pays to get in touch with your local supplier of Shell Industrial Lubricants.

The Research Story

Shell chemists in the U.K., in Holland and in the U.S.A., prepared and examined hundreds of experimental soluble oils, and established that certain combinations of fatty alcohols could be used in place of phenolic compounds with no loss of efficiency. They set to work to discover the best combination and developed a higher fatty alcohol complex which fitted exactly. Then they realised that to blend this new coupling agent into soluble oils would require special plant and new blending techniques.

Exhaustive testing of blend stability, emulsion stability, anti-corrosion and machining properties led to selection of the most promising blends. A pilot plant was set up to produce batches of these for use in field trials.

This field testing and final development proceeded for two years whilst production plants were erected at points so chosen as to give the most economical and rapid delivery throughout the United Kingdom.

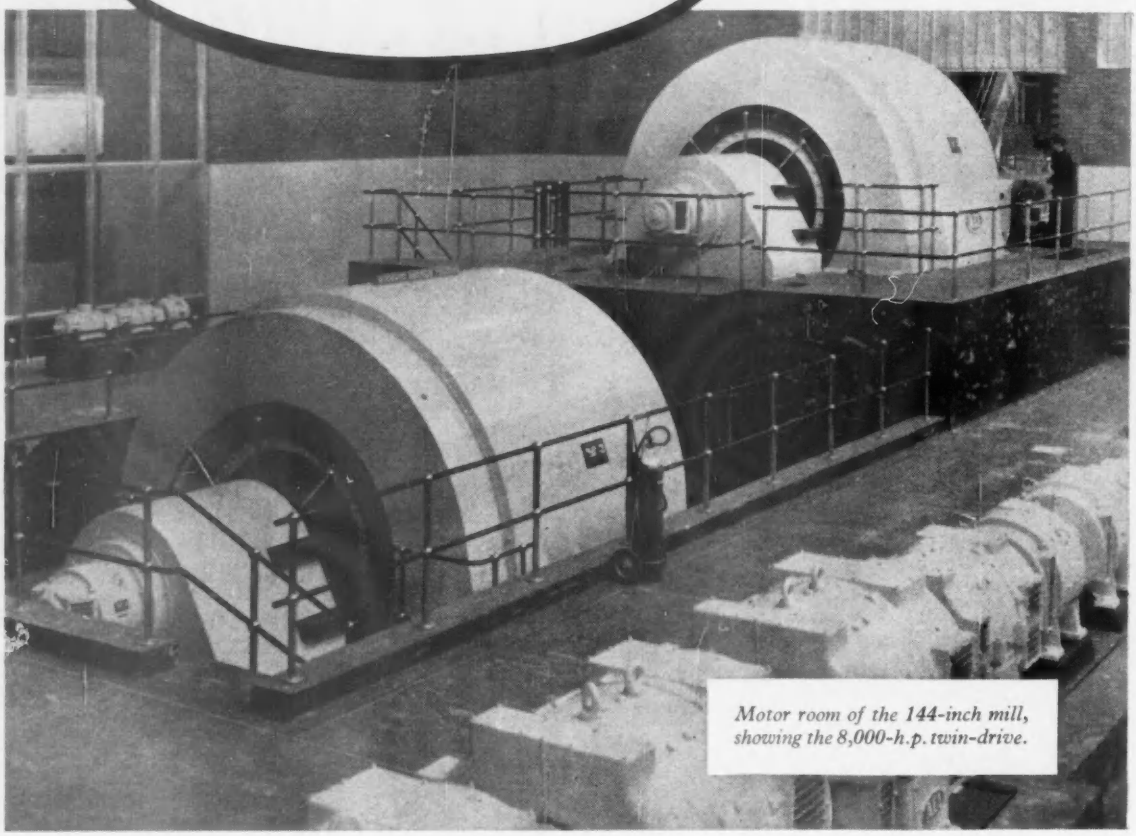


This is the blending kettle. The reflux condenser beside the stirrer motor prevents the loss of constituents volatile at the blending temperature.

NEW SHELL DROMUS SOLUBLE CUTTING OILS

another proof of Shell leadership in lubrication

AEI at ROGERSTONE



Motor room of the 144-inch mill, showing the 8,000-h.p. twin-drive.

For the expansion scheme at Rogerstone Works, AEI have supplied to Alcan Industries Limited (formerly Northern Aluminium Co. Ltd.) all the electrical equipment for the new 144-inch hot reversing mill and for the modernisation and enlargement of the 88-inch hot-finishing mill.

AEI

Associated Electrical Industries Limited

Heavy Plant Division

RUGBY, ENGLAND

A5597

tested up to 31 MVA at 415 VOLTS

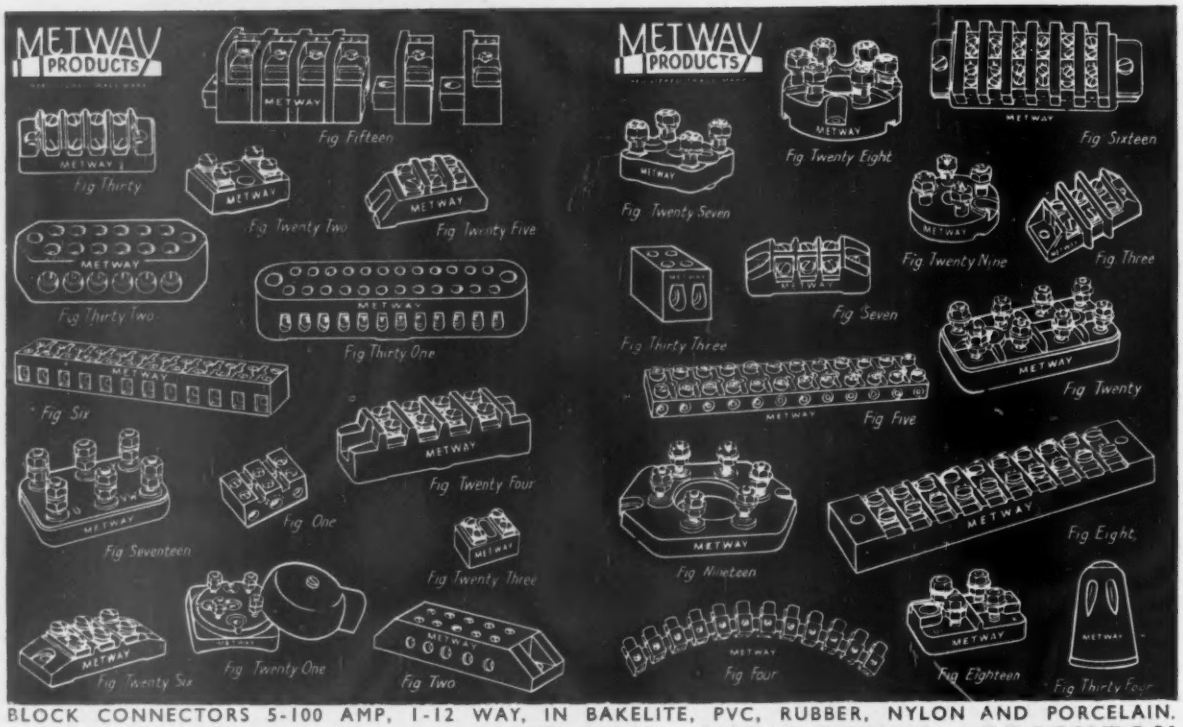
EAC plug-in type Control Centres are designed to cater for direct-on starting of AC motors up to 100 h.p. Each standard column will accommodate a variety of combinations of starter-units, and alterations or additions are readily carried out after installation. There is ample provision for sequence interlocking or remote indication through an adequate number of control circuit plugs.

For full data write for Leaflet 140/E Section 14.

EAC are the ORIGINAL Single-phasing Preventer People

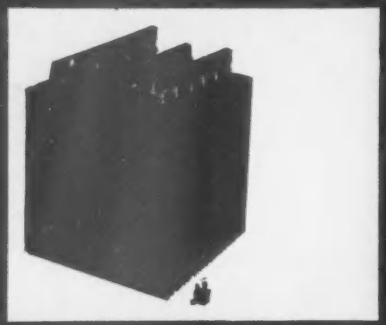
THE ELECTRICAL APPARATUS COMPANY LTD EAC ST. ALBANS

TERMINAL BLOCKS BY METWAY



BLOCK CONNECTORS 5-100 AMP, 1-12 WAY, IN BAKELITE, PVC, RUBBER, NYLON AND PORCELAIN.
★ FOR FULL DETAILS WRITE FOR CAT. No. NBQ/12ET. **METWAY • KEMP TOWN • BRIGHTON**

AUTOMAT



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AUTOMAT MOORSIDE RD SWINTON MANCHESTER
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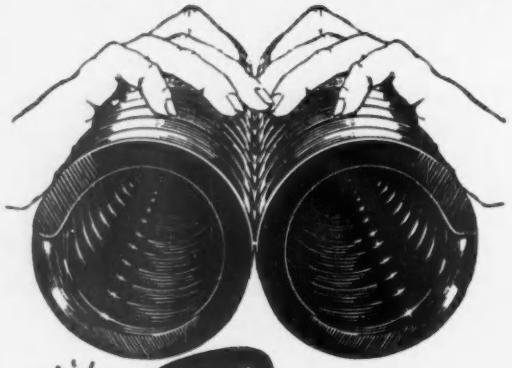
Looking in the right direction



Ratcliffe SPRINGS

F. S. RATCLIFFE (ROCHDALE) **LTD.,**
Crawford Spring Works, Norman Road, Rochdale
Phone: Rochdale 40415 'Grams: Recoil, Rochdale
Telex 63178 CW5968/1

Photograph reproduced by kind permission of the Switchgear Division of Associated Electrical Industries Ltd.

In power stations and substations, on transmission lines and switchgear, the familiar "chocolate soldiers" form part of each characteristic skyline. They stand, sentinels of safety, examples of the combination of engineering know-how and the ancient craft of the potter, which give Taylor Tunnicliff a wealth of background experience unsurpassed in this specialised industry.

No project is too large or too difficult for us to consider, and our record of success in solving problems of great complexity and magnitude leads us to believe we shall solve many more. We should like to hear about yours — preferably at an early stage of the designs.

Daily proving their insulating qualities the world over!

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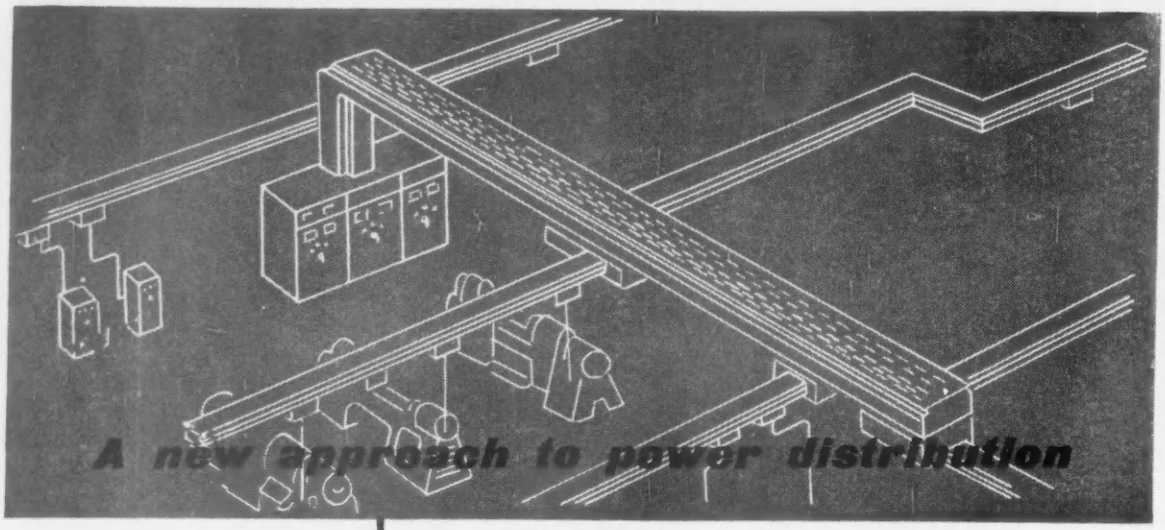
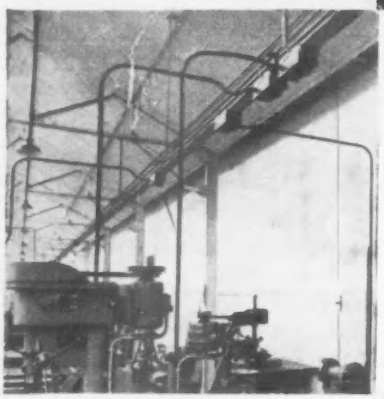


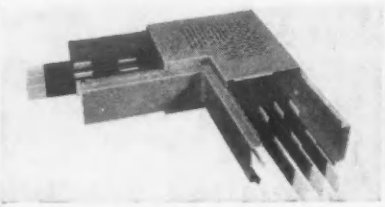
ECONOMICAL
FLEXIBLE
SAFE TAP-OFF BOXES
SILVERED CONTACTS AT JOINTS

British CANALIS BUSBAR TRUNKING

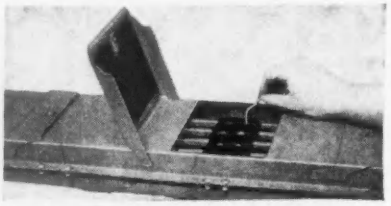


British Canalis Universal applied to workshop distribution. Tap-off boxes easily located adjacent to machine.

- HEAVY STEEL CASING.
- PLUG-IN TAP-OFF BOXES FEED SERVICE CIRCUITS AND ARE FIXED WITHOUT TOOLS.
- OPENING LID OF BOX AUTOMATICALLY DISCONNECTS FROM BUSBARS.
- CONTINUOUS EARTH BAR.
- EASY TO ERECT.



Corner section of heavy current trunking of 1,500 amps rating showing interleaved busbars.



Method of joining sections of British Canalis Universal.

BRUSH

BRUSH ELECTRICAL ENGINEERING CO. LTD. LOUGHBOROUGH

(Member of the Hawker Siddeley Group)

NEWS SHEET

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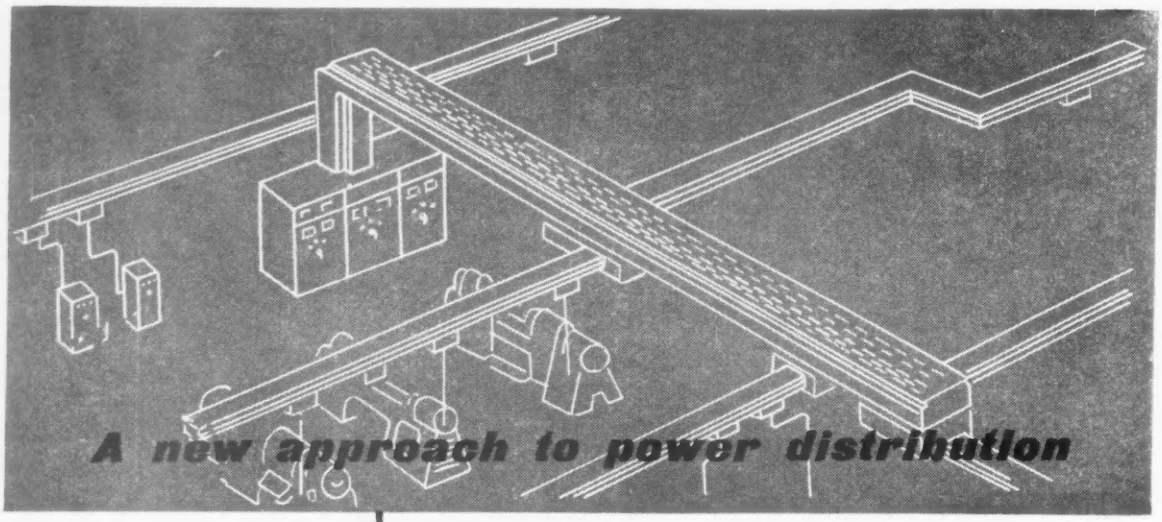

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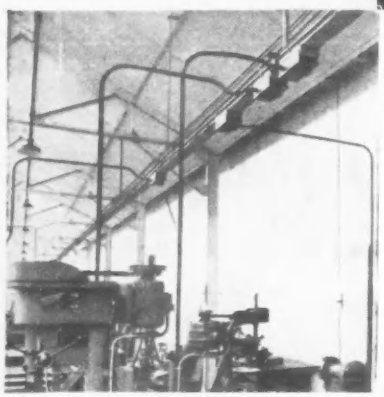

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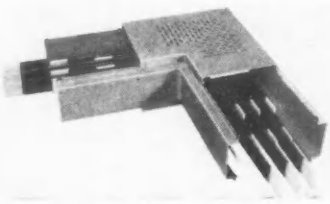

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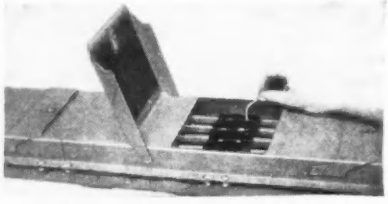

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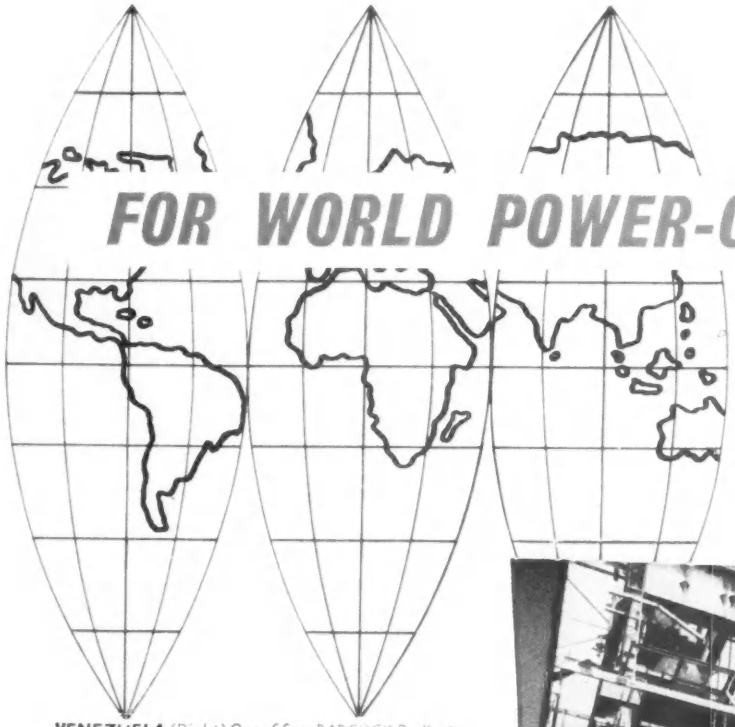
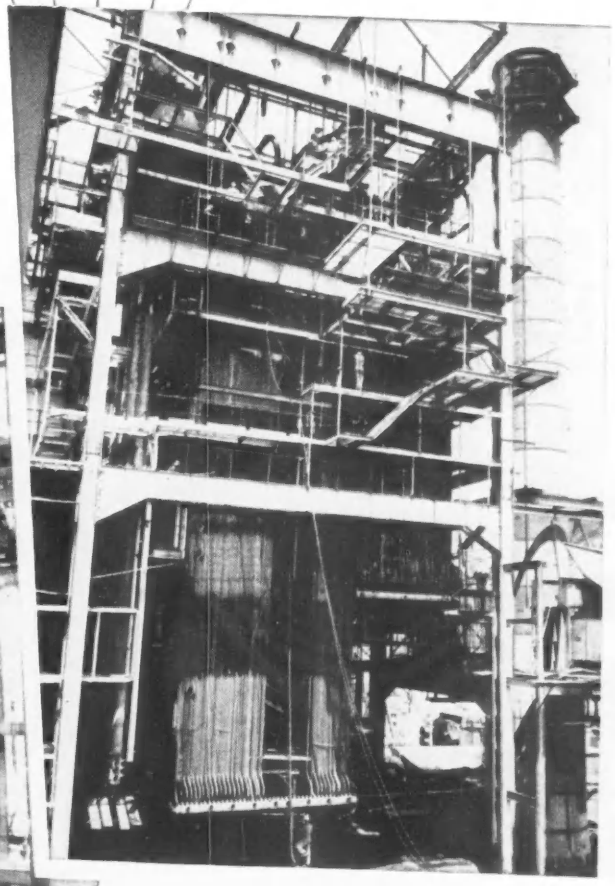


FOR WORLD POWER-GENERATION

STEAM is, by far, the world's most important medium for electrical-power generation and a very high proportion of the world's power stations is equipped with BABCOCK steam-raising plant.



VENEZUELA (Right) *One of four BABCOCK Radiant boilers, natural-gas and oil fired, each rated at 550,000 lb./hr.; during erection for La Electricidad de Caracas. (Consulting Engineers: Sofina)*

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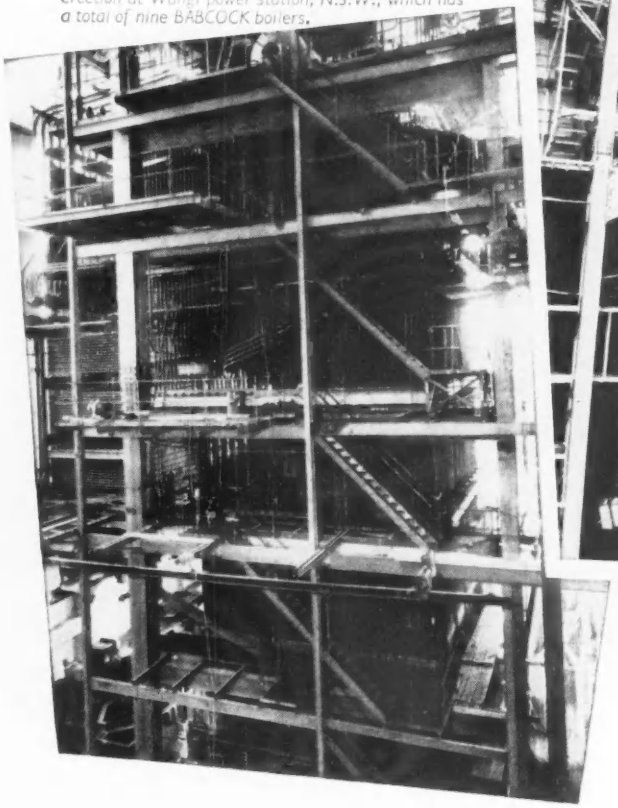

BABCOCK

STEAM-RAISING PLANT

BABCOCK & WILCOX LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.1.

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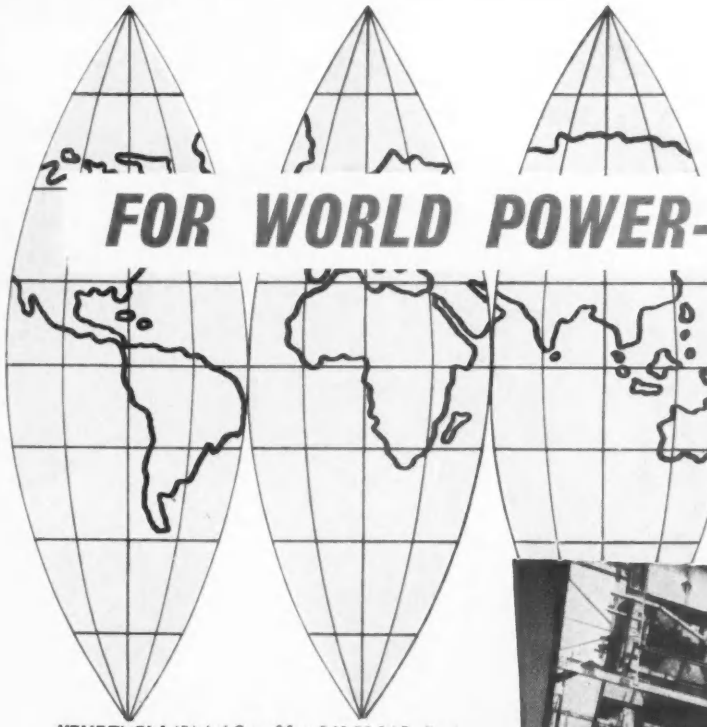

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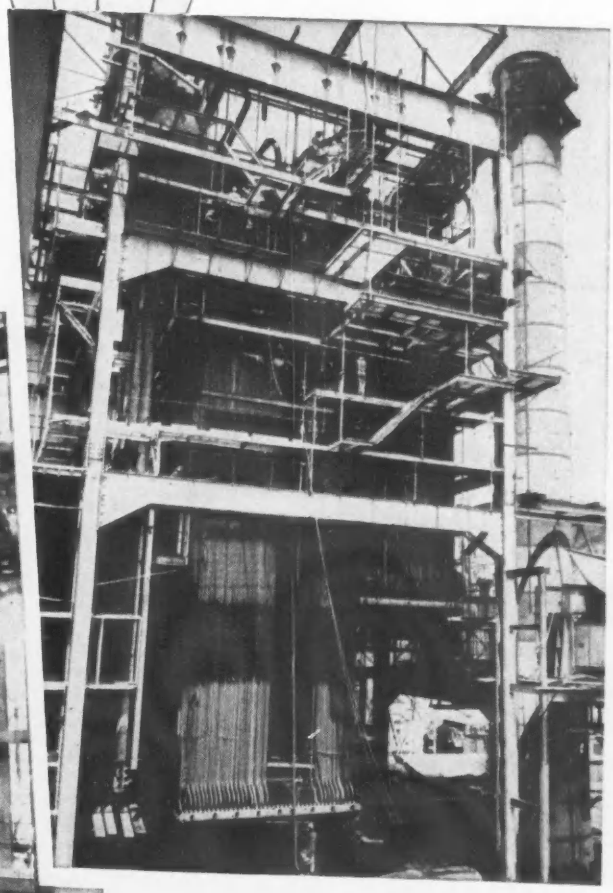

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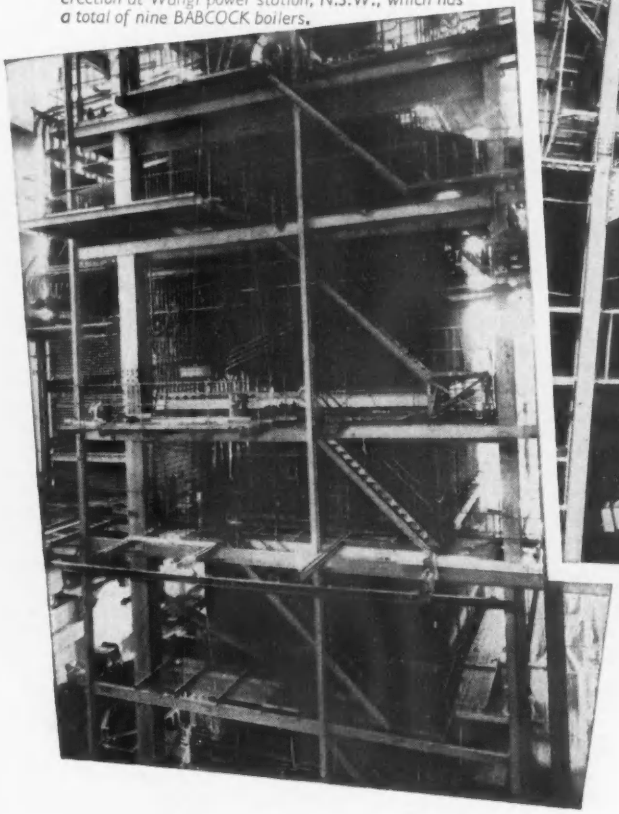

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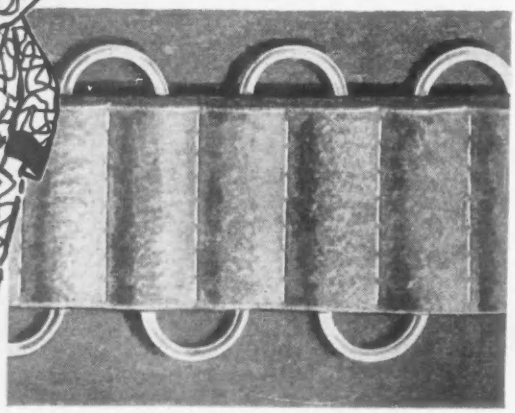
AIR BREAK SWITCHGEAR

415 VOLT A.C
DISTRIBUTION SWITCHBOARD
WITH 26MVA DRAWOUT TYPE
CIRCUIT BREAKERS AND A
3000 AMP 4 POLE ISOLATOR

BERTRAM THOMAS
(ENGINEERS) LTD.
MANCHESTER 15

It's 'Element'-ary ...



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If you've used an asbestos core, cover with asbestos roving wound contra-directionally to the wire spiral.
If you've used rayon or glass fibre cover with top grade P.V.C. plastic, because this gives a seamless, waterproof, and electrically-insulated covering.
Done it? Well, you've made a flexible Electric Heating Element . . . but it won't have the *consistent* quality of those made by **CLARKSON BROOKE & CO. LTD.**, leaders in the field with years of specialist experience.
Clarkson Brooke make heating elements for electric pads, blankets, night storage heaters, domestic drying cabinets, and pipe wrapping to maintain the temperature or viscosity of liquids.
Clarkson Brooke heating elements are made to the very highest standards for many leading electric appliance manufacturers.

For more information, write or 'phone:

CLARKSON BROOKE & CO LTD
HILLARY CHAMBERS, HILLARY PLACE, LEEDS 2. Telephone: 29668
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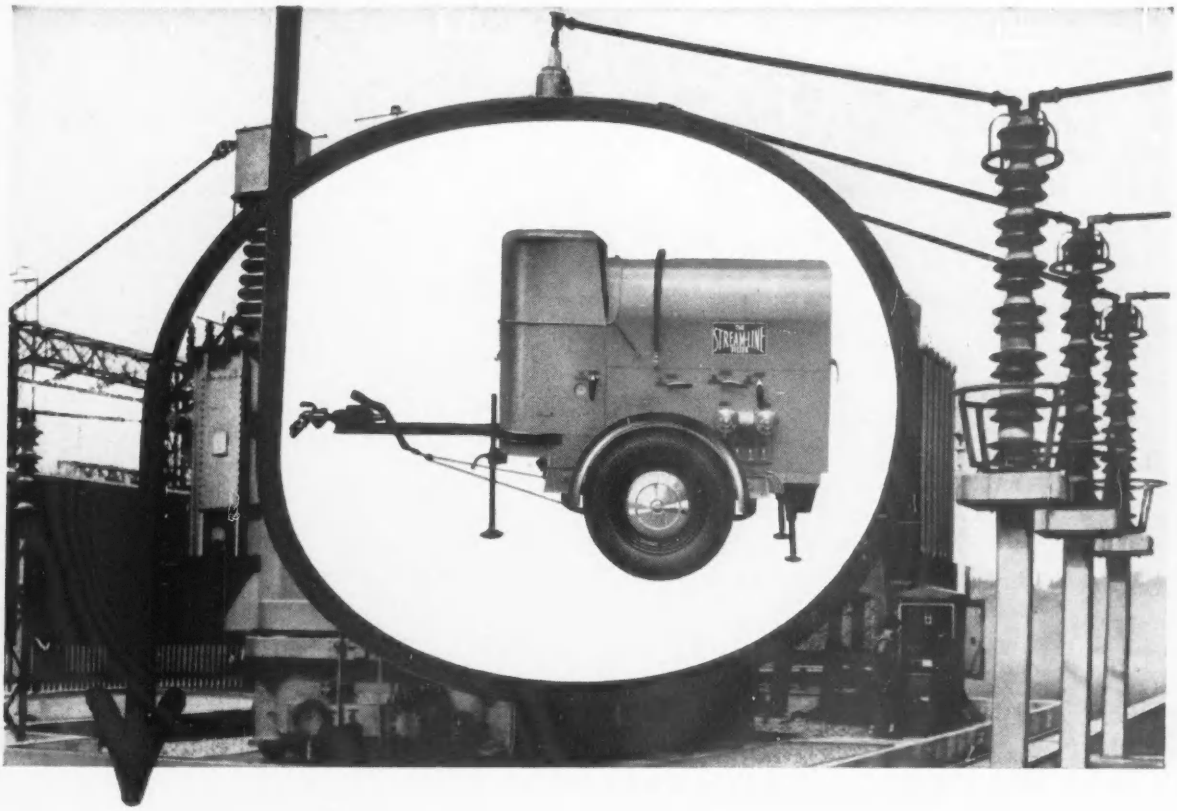
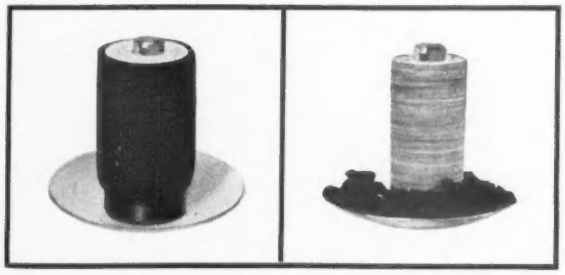


Loop in a Stream-Line filter



These illustrations show the Stream-Line filtering element built up of special paper discs under end pressure. Oil passes through the infinitesimal interstices between the discs leaving solid impurities at the paper edges. Instantaneous cleaning is carried out by a reverse flow of compressed air.

The security of oil-immersed circuit-breakers and transformers depends on the condition of the insulating oil, for if it contains impurities and moisture a serious loss of insulating protection will occur. The Stream-Line filter, embodying filtering elements, heating chamber and vacuum receiver, is the most perfect practical safeguard against this happening. A *single* passage of oil through a Stream-Line filter ensures the elimination of *all* solid impurities including the finest colloidal carbon. In addition, dehydration and de-aeration ensure the removal of all free and dissolved water and gases—*and the filtered oil will have a dielectric strength far above that specified for new oil.*

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The standard Stream-Line filters, working at moderate vacuum, are fully adequate for most requirements but in order to cater for exceptional cases models are also available to operate under high vacuum. Treatment under conditions approaching absolute vacuum, combined with the unique Stream-Line edge-filtration principle, gives results with regard to the elimination of the last traces of air and moisture which are quite remarkable. Send us particulars of *your* special requirements.

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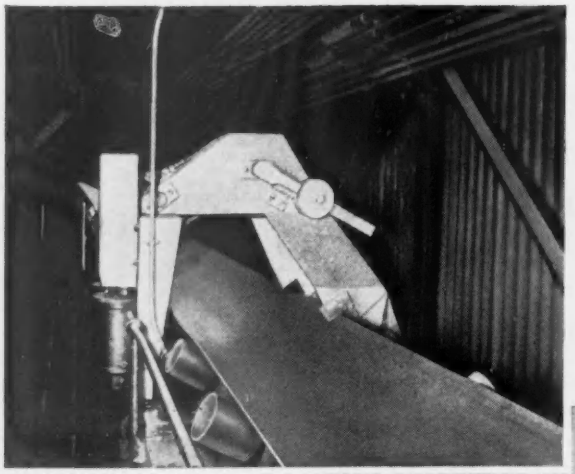

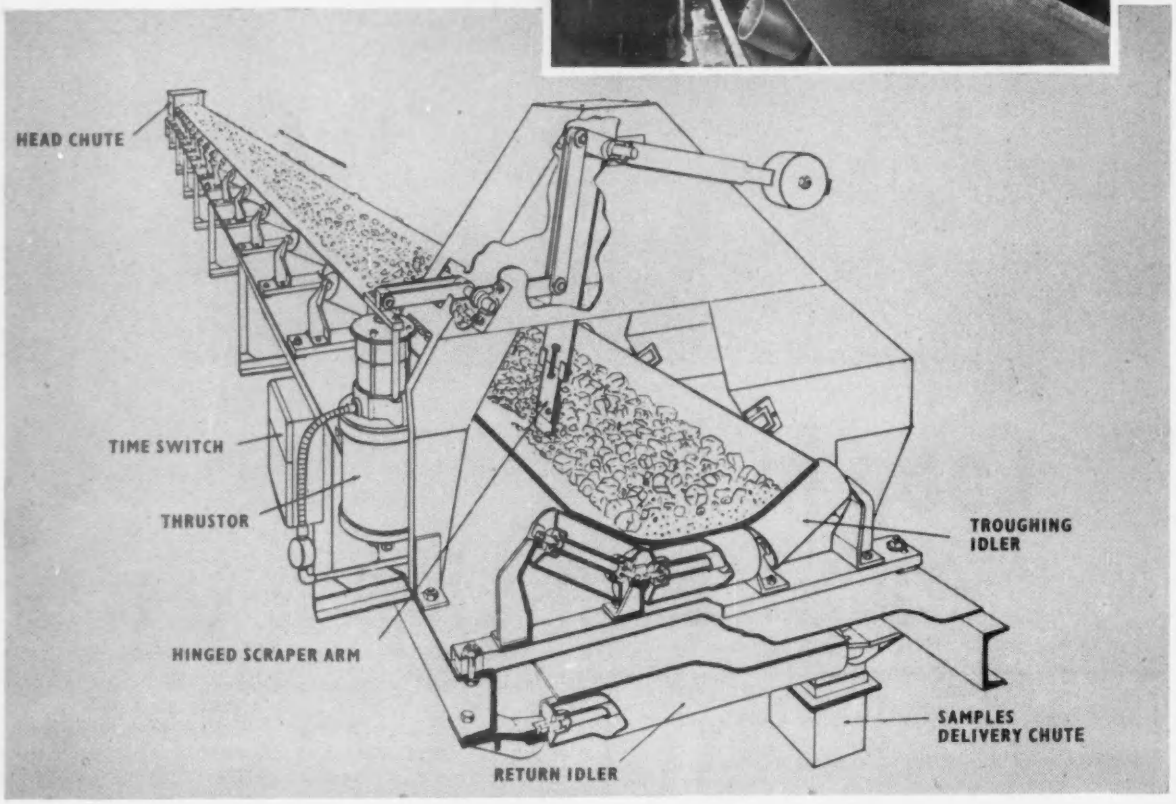

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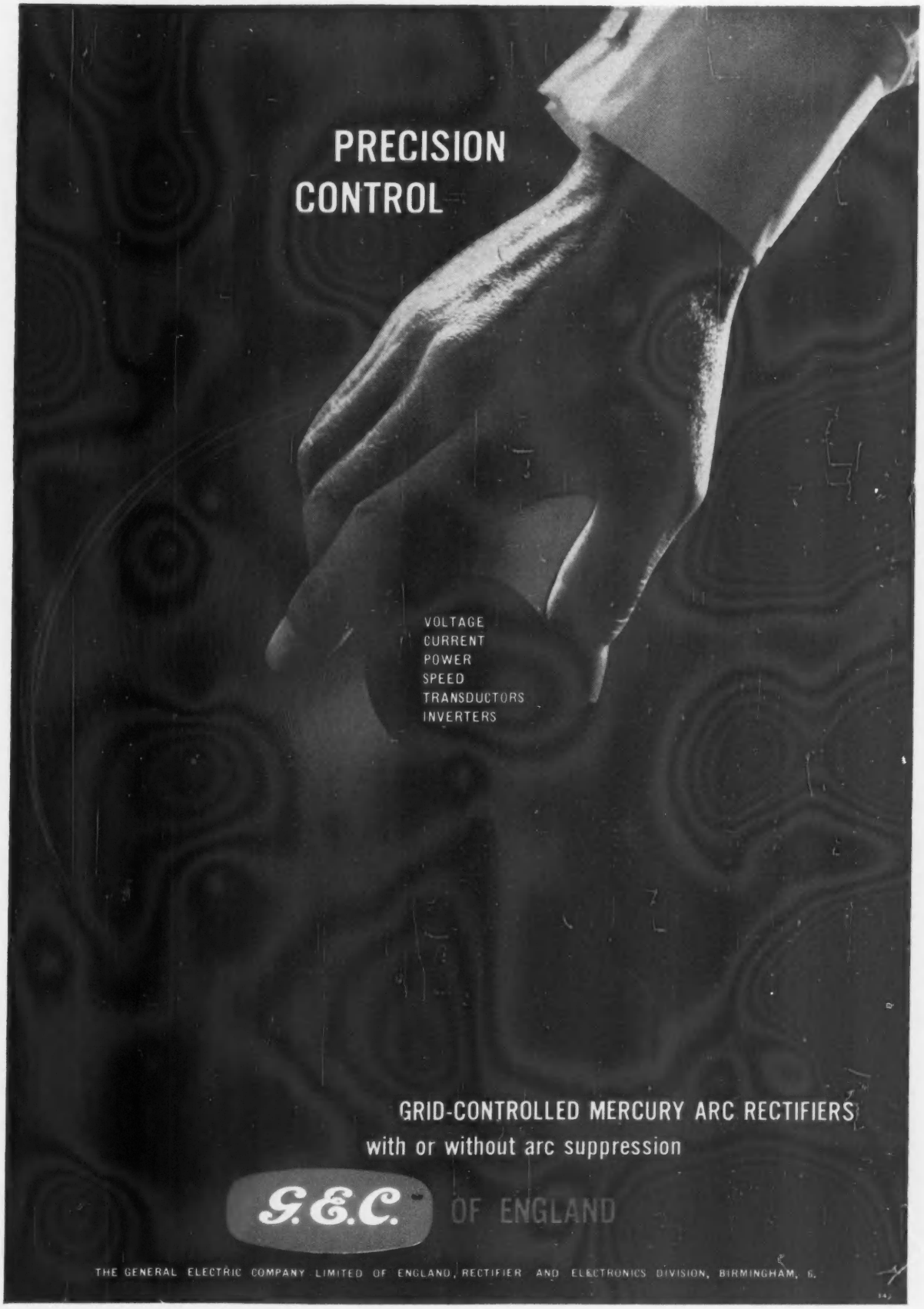
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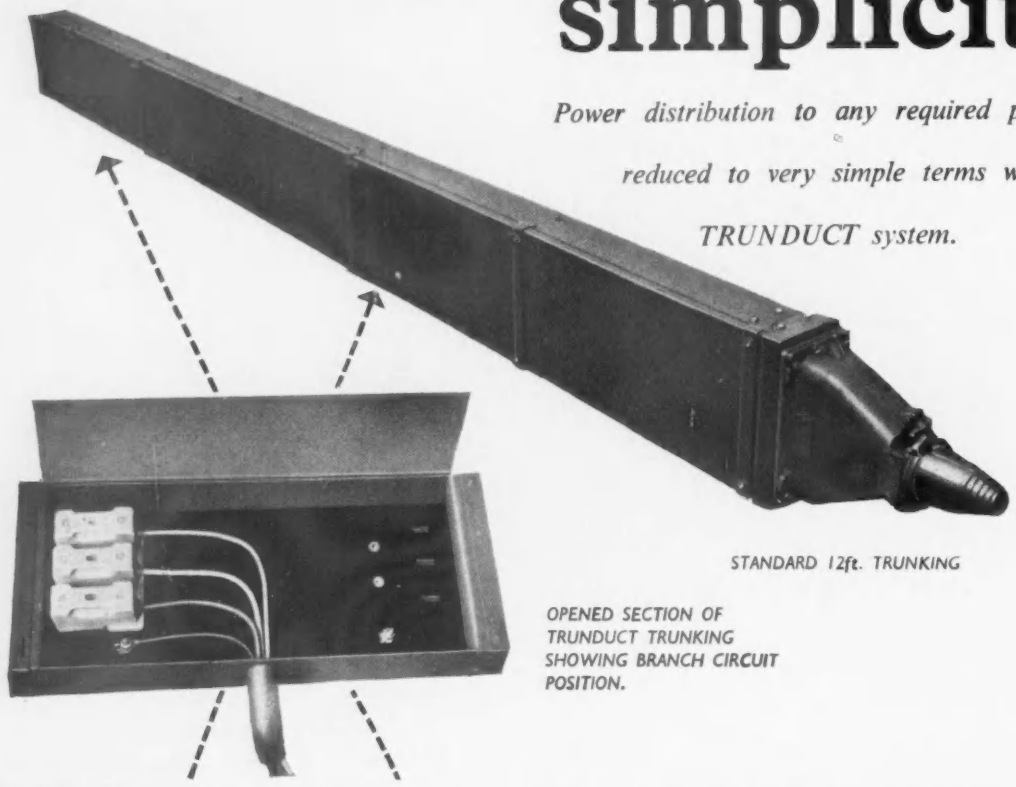

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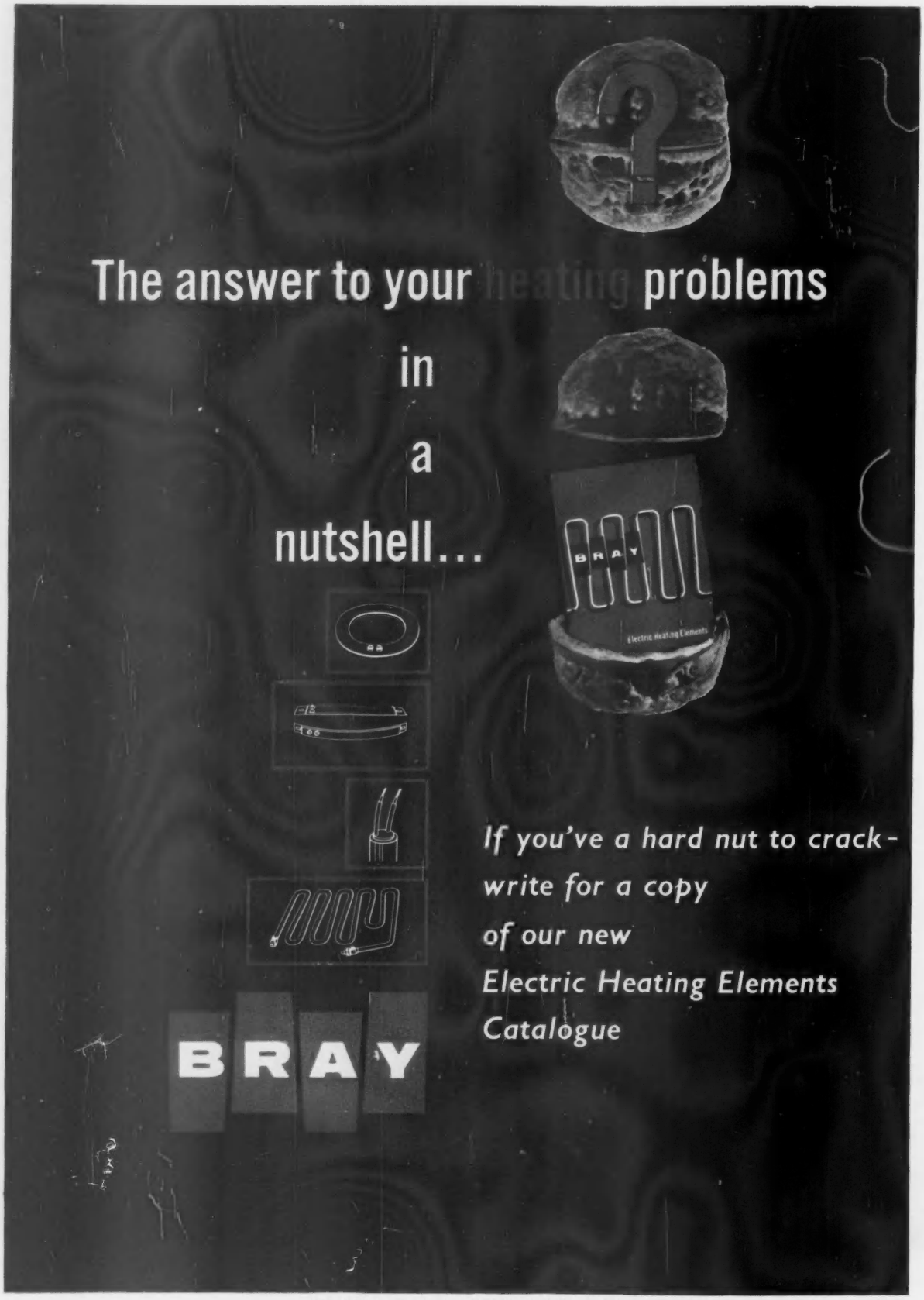

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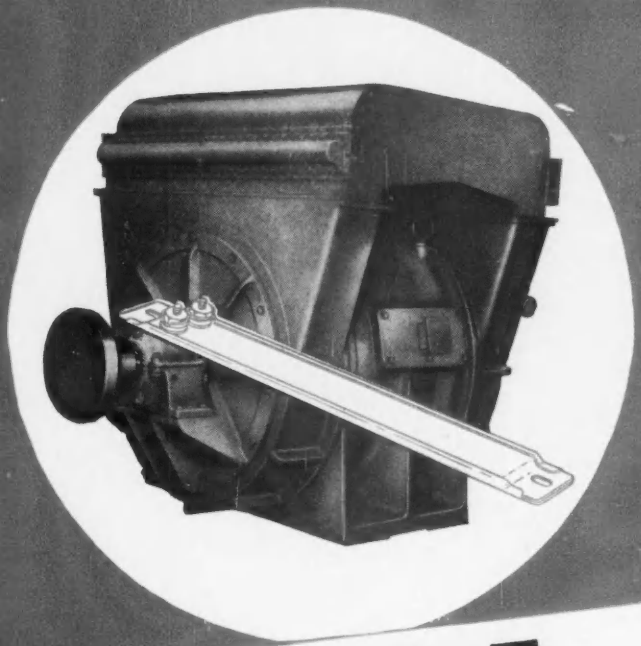

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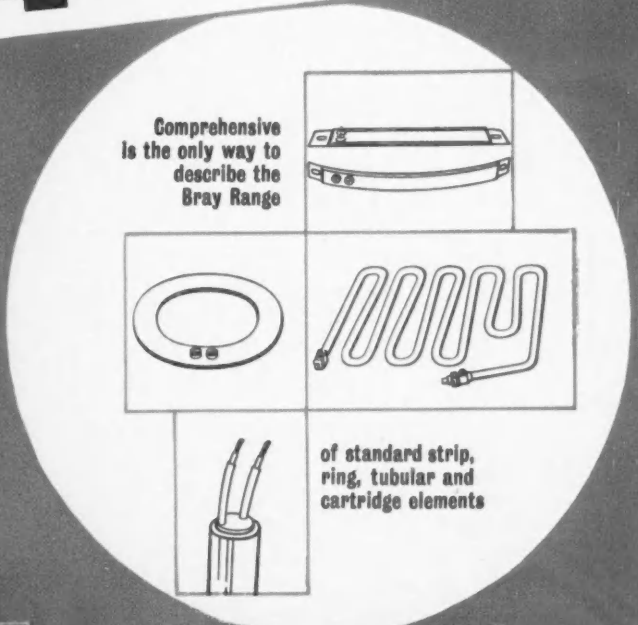

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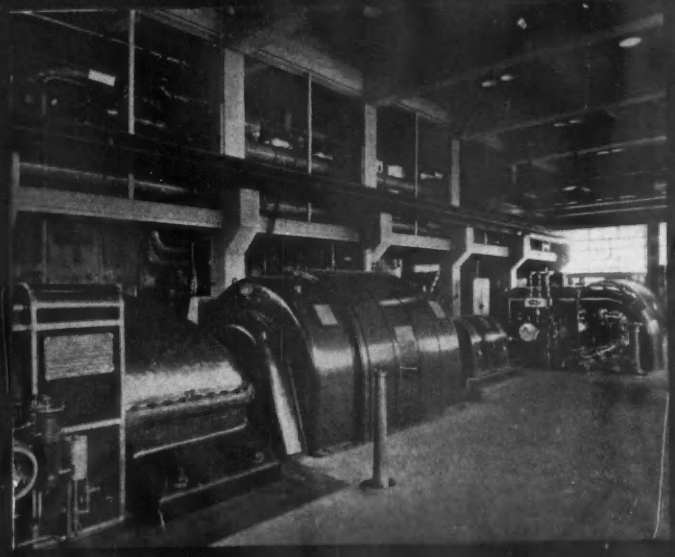

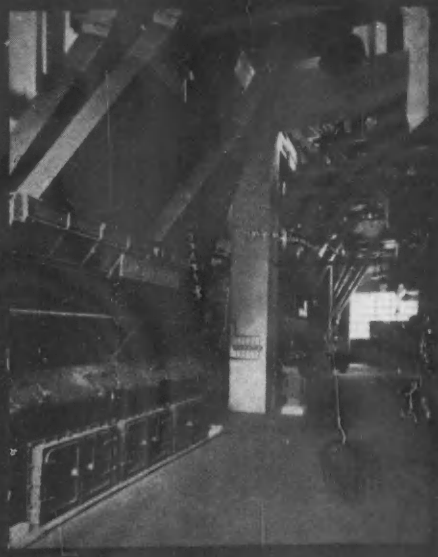

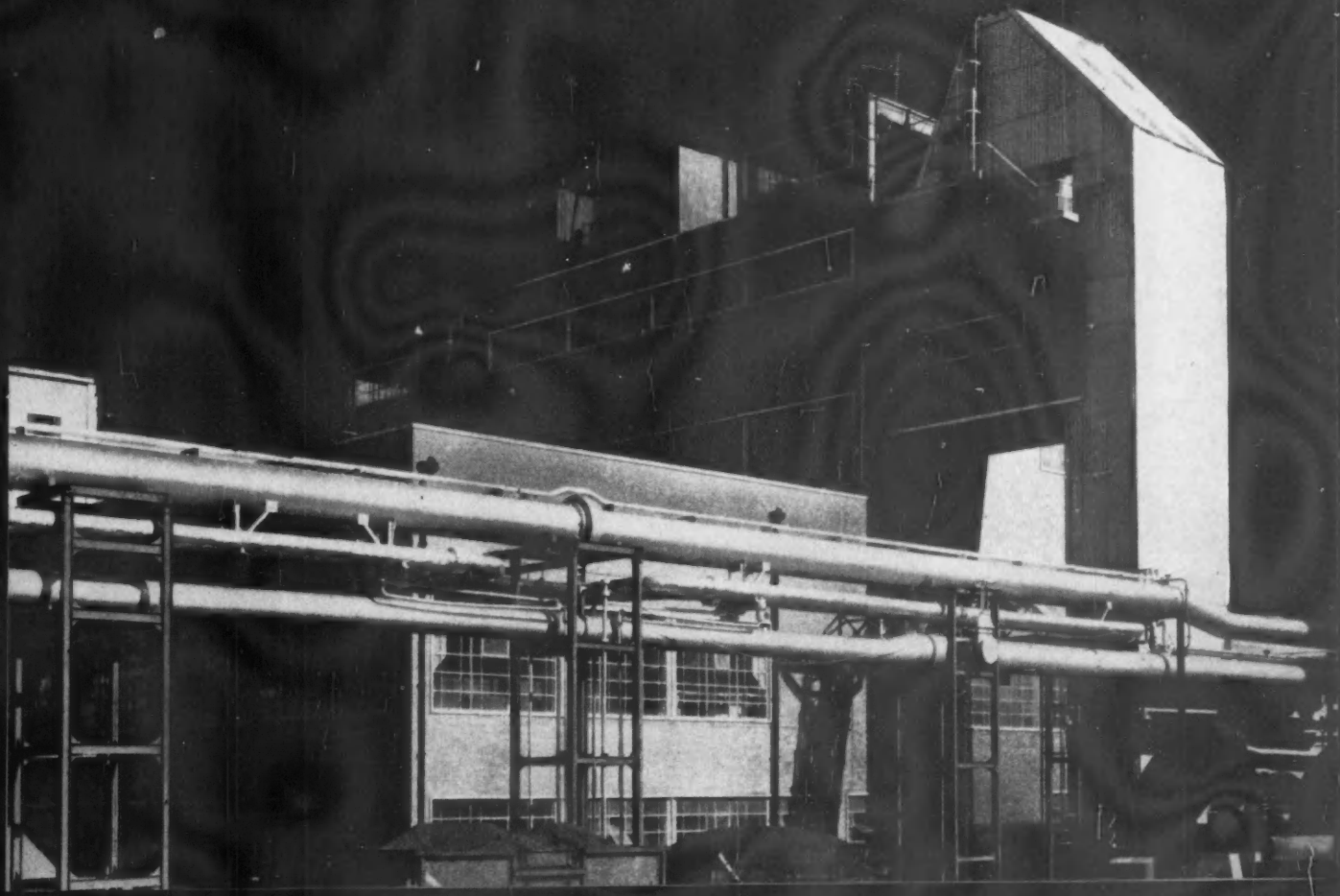

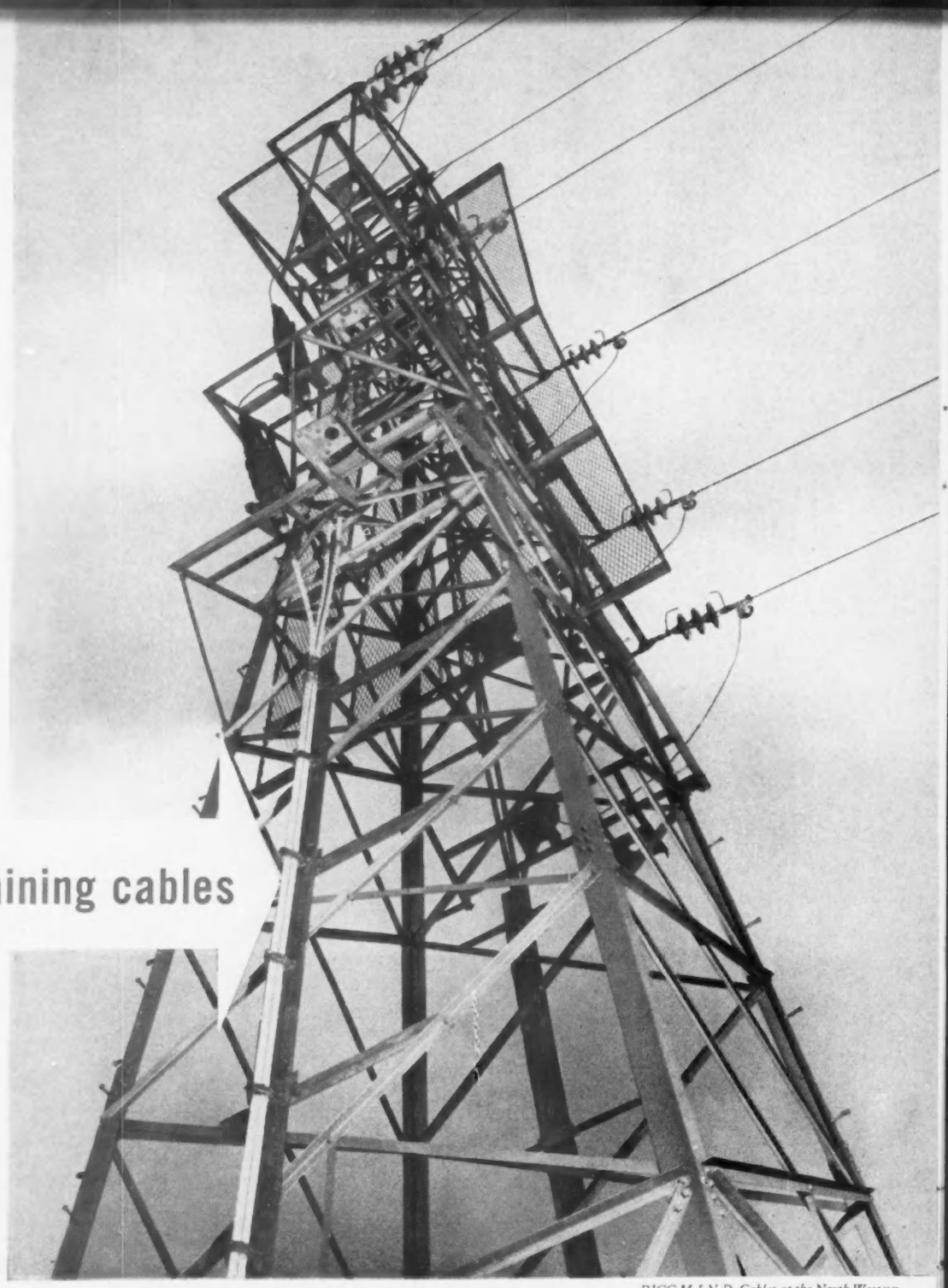

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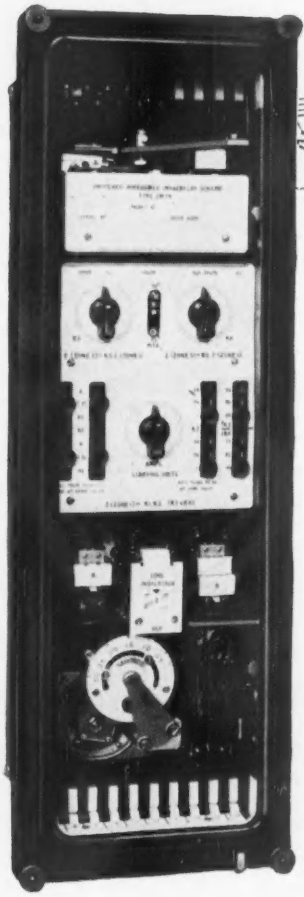

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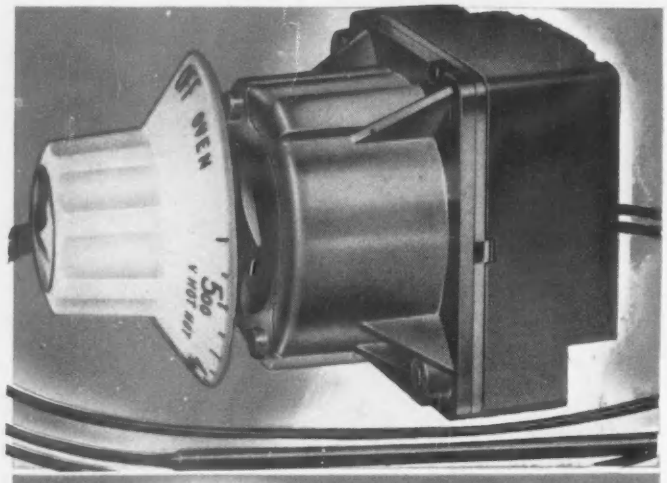

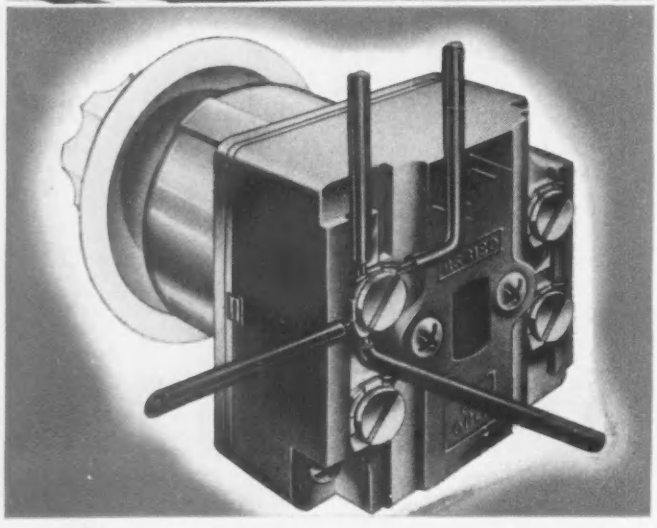

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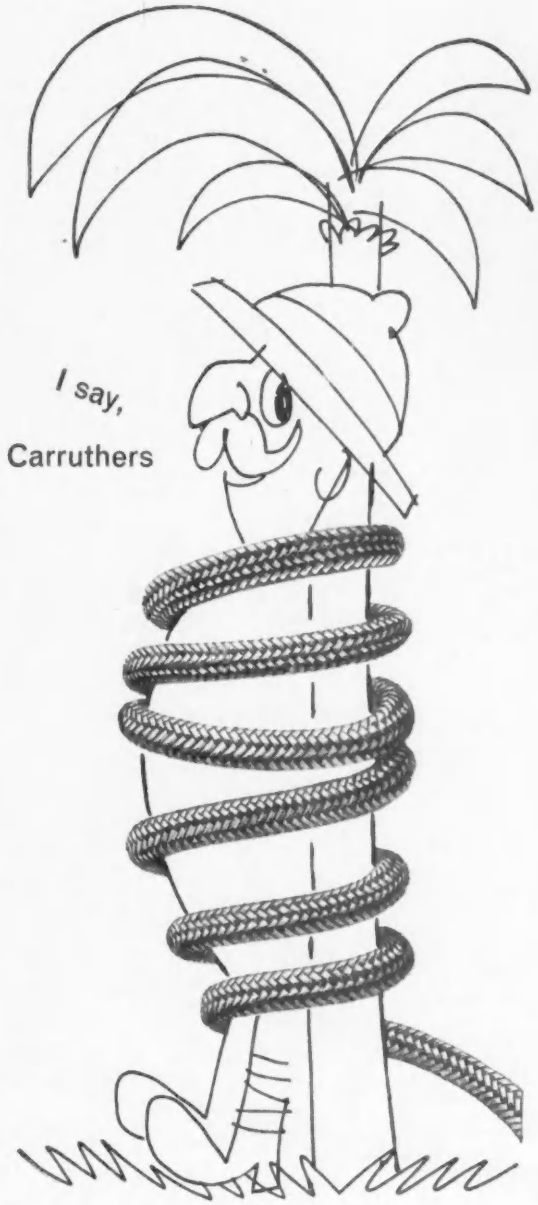

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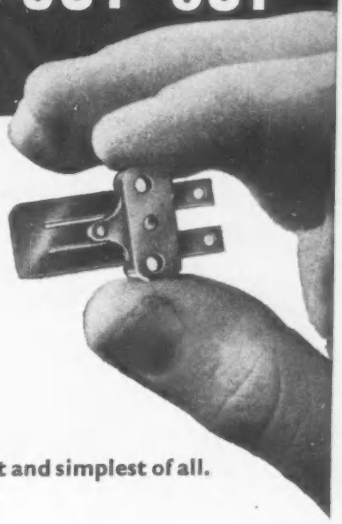

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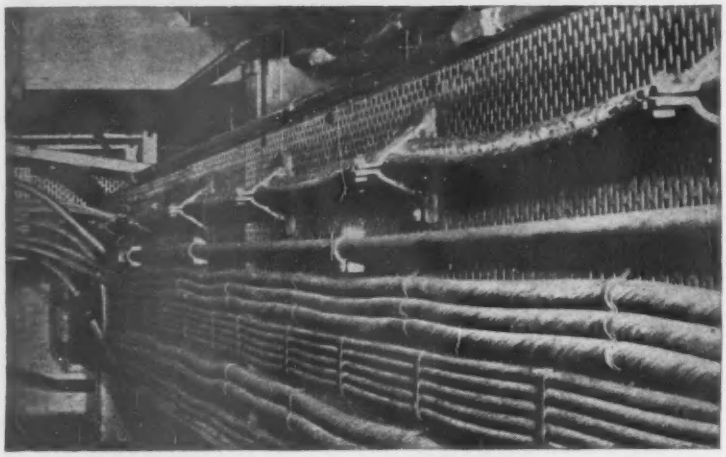

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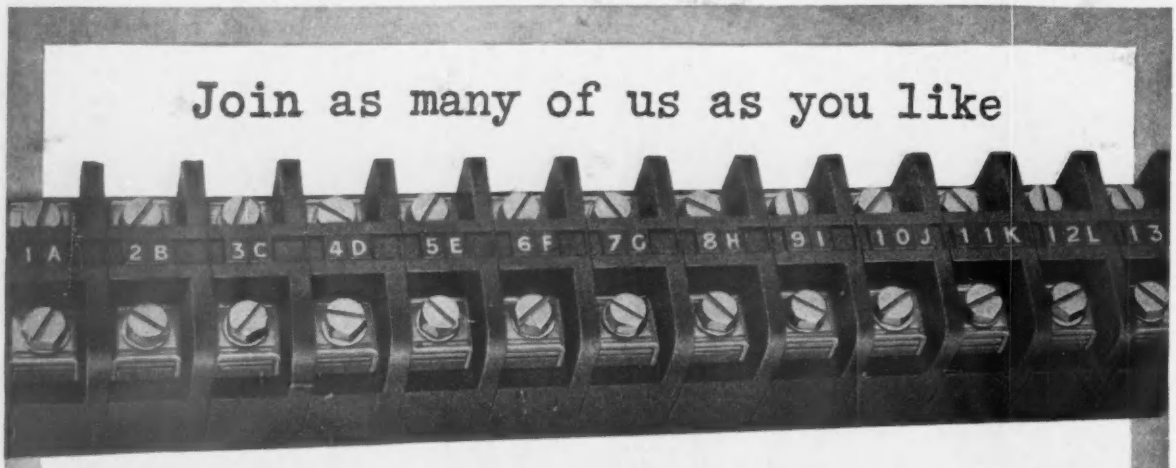
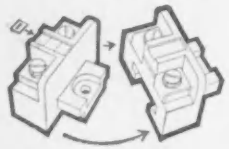


MTE MULTI-LOCK TERMINAL BLOCKS



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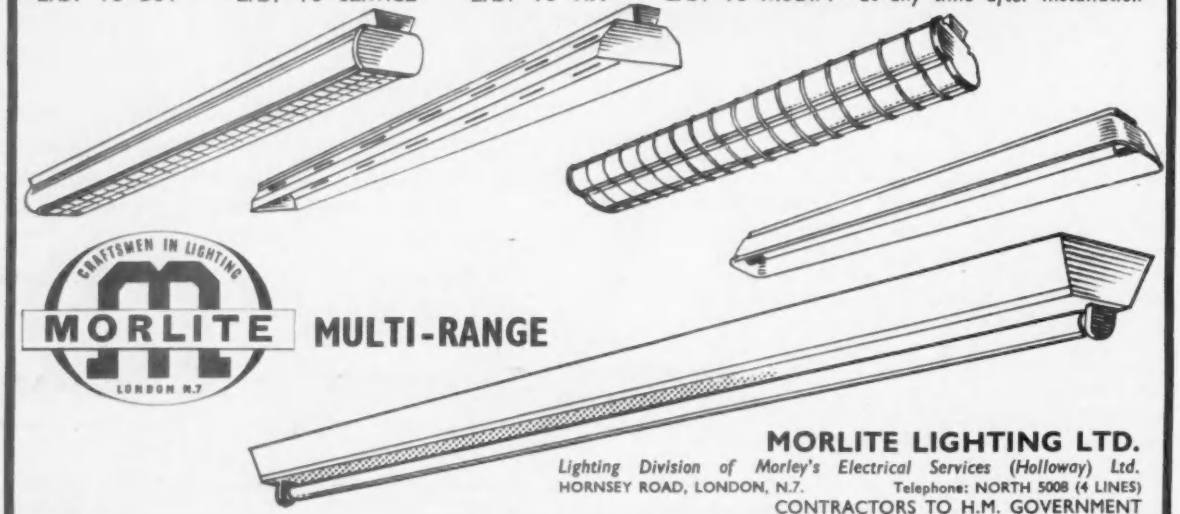

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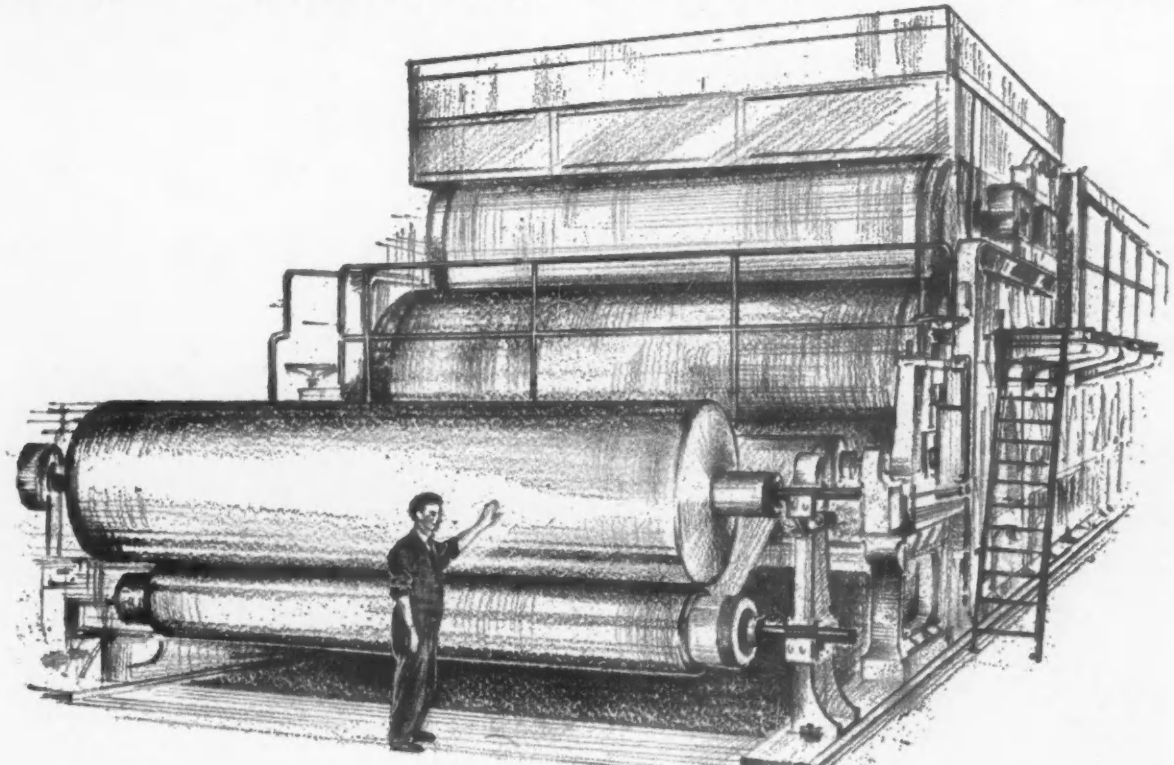

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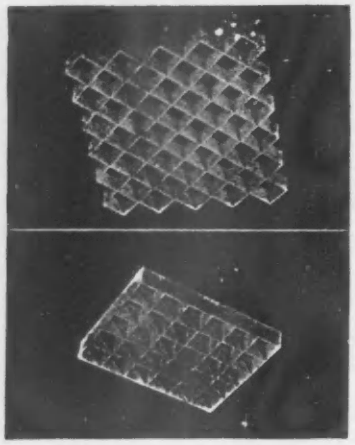

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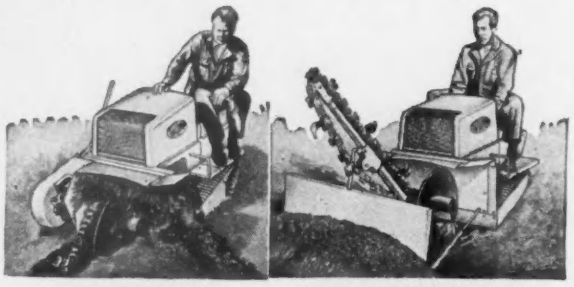

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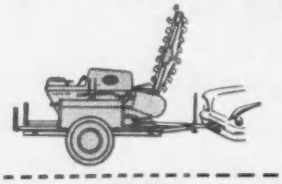

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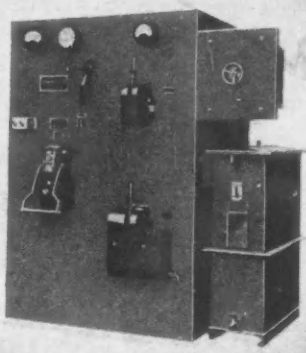

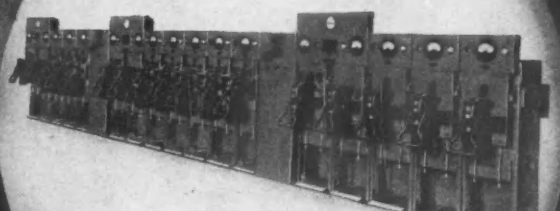

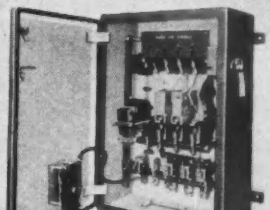

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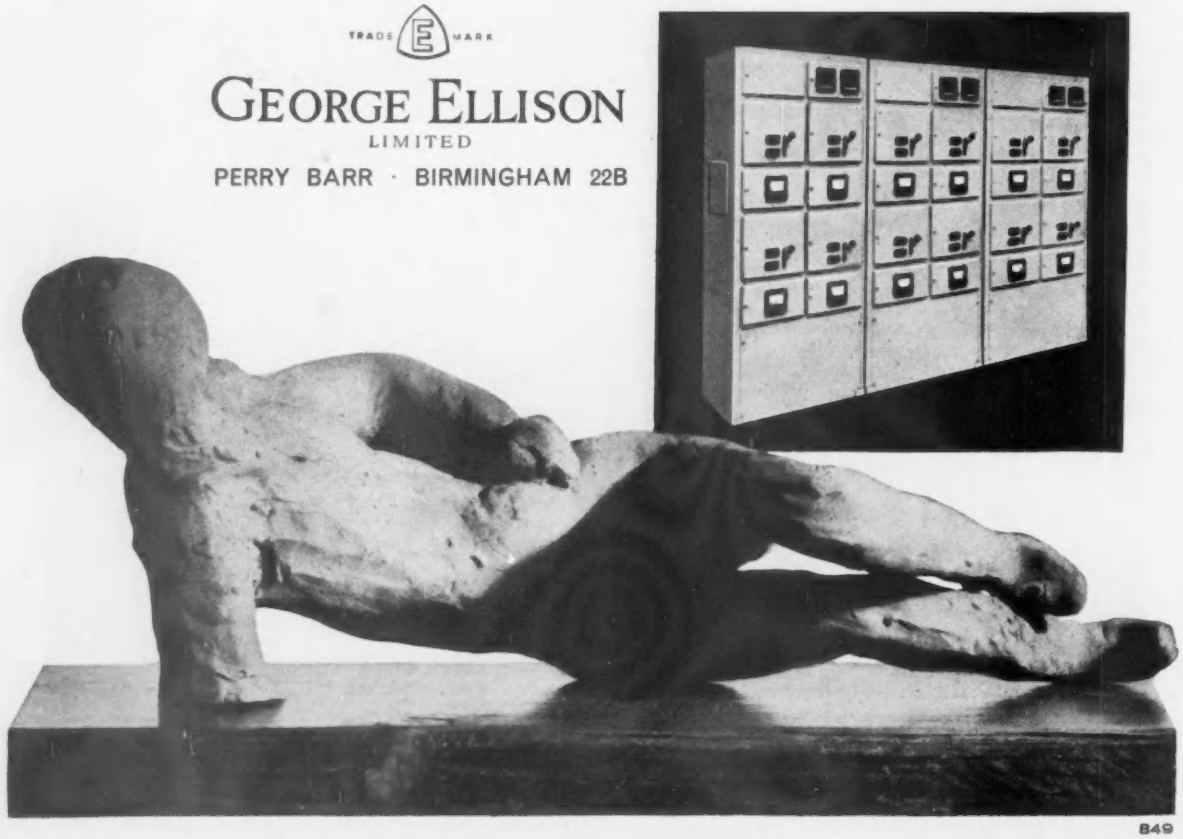

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THURSDAY 17 NOVEMBER, 1960
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
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Dans ce numéro

Protection coordonnée de feeder/transformateur ... 747

La fonction principale des dispositifs de protection des systèmes de distribution d'énergie électrique est de parer aux effets des fautes et localiser les zones troublées. La célérité d'opération est essentielle lorsque des fautes transitoires se révèlent qui, étant dommageables, pourraient devenir autant de fautes persistantes. Dans le cas de réseaux à double lignes entre la source et la faute elle-même, ces deux lignes devront être isolées. Le problème de la coordination des réglages des relais protecteurs, interrupteurs et retardements dans le but d'effectuer un fonctionnement judicieux est discuté.

Moteur d'induction à vitesse variable ... 753

L'usage d'un enroulement statorique disposé de telle façon que l'espacement physique entre les centres des groupes de phases permet d'obtenir la vitesse variable d'un moteur d'induction, cage écureuil. L'enroulement statorique est alimenté par un transformateur polyphasé incorporant un enroulement à espacement logarithmique. L'interconnexion des deux dispositifs a pour effet de changer le nombre effectif de pôles sur le stator du moteur, soit donc le pas des pôles et, conséquemment, la vitesse. La technique en question a été dénommée "etirage de la pole".

Présentation de Combustible Nucléaire 769

Dans les réacteurs d'énergie nucléaire britanniques, l'uranium est contenu dans des bidons d'alliage au magnésium. La forme employée pour les réacteurs de distribution d'énergie consiste soit d'ailettes hélicoïdes à l'extérieur du bidon et d'ailettes longitudinales ("fendeuses") pour disperser le passage des gaz: soit encore des fendeuses hélicoïdes et ailettes longitudinales. La considération de la chaleur mène à ce choix de forme.

In dieser Nummer

Ausgerichteter Speisetransformatorschutz ... 747

In Kraftstromnetze eingebaute Schutzvorrichtungen dienen vor allem dazu, den Auswirkungen von Netzfehlern vorzubeugen und Störbereiche einzugrenzen. Bei vorübergehenden Störungen ist ein schnelles Ansprechen der Schutzvorrichtungen von primärer Bedeutung, damit keine Beschädigungen entstehen, die leicht zu Dauerstörungen führen könnten. Gibt es zwei stromwege zwischen Stromquelle und Fehlerort, so muss für die Trennung beider Leitungen Sorge getroffen werden. Der Artikel befasst sich mit dem Problem der Koordinierung bei der Einstellung von Schutzrelais, Unterbrechern und Verzögerungsvorrichtungen wenn es sich darum handelt, eine selektive Wirkungsweise zu erzielen.

Asynchronmotor mit veränderlicher Drehzahl ... 753

Die Verwendung einer Statorwicklung, die so angeordnet ist, dass die räumliche Entfernung zwischen Phasengruppenmittelpunkten veränderlich ist macht es möglich, einen Asynchronmotor mit Kurzschlussläufer als Regelmotor zu betreiben. Hierzu wird die Statorwicklung von einem phasenvervielfältigenden Transformator gespeist, eine Wicklung mit logarithmischer Teilung aufweist. Durch Verbinden dieser beiden Vorrichtungen untereinander lässt sich die wirksame Polzahl des Motorständers und damit dessen Polteilung und folglich die Drehzahl des Motors ändern. Für dieses Konstruktionsprinzip ist die Bezeichnung "Poldehnung" geprägt worden.

Ausführungsform nuklearen Brennstoffs 769

Das in britischen nuklearen Kraftwerken verwendete Uran wird in Behältern aus Magnesiumlegierung geliefert. Die für die Reaktoren von nuklearen Stromerzeugungsanlagen verwendete Ausführungsform dieser Behälter weist entweder schraubenförmige äussere Rippen und längsangeordnete Rippen ("Aufspalter") oder umgekehrt schraubenförmige Aufspalter und Längsrippen zur Zerteilung des Gasstromes auf. Diese Formgebung beruht auf Wärmedurchgangserwägungen.

Co-ordination of Feeder and Transformer Protection 747
by A. Salzmann, DIPL.ING., A.M.I.E.E.

Variable Speed Induction Motors 753

15 MW Gas Turbine Alternator for Peak Power ... 755

E.I.B.A. Ball, 1960 757

INDUSTRIAL ELECTRICITY

Extending an Aluminium Plate and Strip Mill ... 763

Crane Control 765

Automatic Gauge Control for Plates Mill 766

Lighting an Iron and Steel Works 767

Fuel Element Shapes 769

Sensitive Earth-fault Relay 770

Electricity in Aircraft 771

Improved Lighting at Liverpool Street 774

Inspection Council Progress 775

Packaged Switchgear 775

FEATURES

Notes on Wiring *by Megohm* 756
Overseas News 758
Personalities in the Industry 760
New Literature 762
British Standards 762
Equipment for Industry 772
For the Electrical Trade 773
News of the Week 776
Company Activities 783
Commercial Information 784

News Sheet 21
Classified Advertisements 55
Index to Advertisers 64

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Gravesend's biggest—for Leicester

The largest oil-filled cable ever to be made at AEI's Gravesend Works is this 132 kV 3-core giant, laid under the busy streets of Leicester. 8,000 yards of this cable was installed by the AEI Construction (Cables and Lines) Division for the East Midlands Electricity Board, to reinforce the supply to the northern area of the city.

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 17 NOVEMBER, 1960

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Comment

SHORT-CIRCUIT IN TRADE

Net price trading direct to large users is on the increase in the electrical industry; it is becoming so prevalent that last week a public protest against it was made by a well-known contractor. The names of the manufacturers and wholesalers indulging in this form of short-circuiting of contractors are commonly known, though spoken only with bated breath. It is in the lighting field that the practice has principally, though not wholly, developed; and here at least there may be some sympathy for the manufacturers' viewpoint. They maintain lighting design departments and often deal direct with large users in the planning of installations. It may seem a natural corollary to them to extend this to direct trading on net terms. On the other hand, the electrical contractor has a firm stake in the installation, not only in the fixing and connection of fittings, but in his overall responsibility for the installation, a stake that was recognised in the former discount structure. Discounts have to be earned, not merely acquired, and if pricing policy of contractors reflected this more patently it would be less easy for net price selling to extend. The real difficulty arises from the uncertainty of the discount situation at the time of tendering. There seems little doubt that the orderly trading conditions of the past will be under continuous attack in the future. The temptation to secure an initial trading advantage will always be there, without thought to the eventual outcome to which such practices may lead. Fortunately, there are still many in the industry who favour more orderly trading. Some discussions have already taken place between associations on this particular problem of net price selling, but inevitably the RTP Act hangs heavily over all such proceedings. Yet some solution must be found, even though it be no more than strong self-discipline, if trading conditions are not to deteriorate to the level they have in some other countries. It is just such cases as that discussed here that are in the minds of those who urge the retention of some form of fair trading forum.

GAS TURBINE TACTICS

Announcement that the CEGB is to spend £200,000 on an experimental 15 MW gas-turbine plant for installation at Hams Hall raises questions about the best way to use such low capital cost units in electricity supply. Installation of this particular unit at a power station has presumably been decided on as a convenient arrangement for a prototype whose abilities are still to be investigated. (Provision of a 20 MW-rated alternator may be significant.) The quick-starting characteristic of gas-turbine generators and their suitability for remote control without continual

attendance, demonstrated in this country in the 3 MW SWEB installations, otherwise call for installation nearer load centres, where transmission losses are minimised and standby value—so far as consumers are concerned, at least—is at a maximum. If the trials prove successful, 15 MW at just over £13/kW in capital cost for the complete set is going to be a weapon worth thinking about in the fight with the peak demand. Relevant figures in financial terms include peak kW on the bulk supply tariff chargeable at £7 2s, and interruptible supply allowance of £3 19s/kW. Taken in conjunction with standby advantages, that sort of cost is likely to make area boards think hard about their generating rights under the 1957 Electricity Act, and the larger industrial undertakings wonder about their own peak-lopping possibilities.

COMMERCIAL FREEDOM IN SUPPLY

Last week's House of Commons debate on investment in nationalised industries brought out the usual rash of MPs who are concerned at the high level of investment demanded by electricity supply. Many of them made speeches showing clearly that they had not studied their subject before offering the Government the benefit of their advice; but amongst the more thoughtful contributions to the debate there recurred a theme which needs countering by the supply industry. It is the argument that MP's should consider in some detail the annual investment programmes of each nationalised industry, every year, immediately after they are approved by the Government. This is additional to the study of the industries, one by one, by the Select Committee on Nationalised Industries, which now seems to have established itself, after an uncertain beginning, as an effective element of the House of Commons machinery. The full Select Committee inquiry will come round to each board about once every seven years, providing the overall outside evaluation which Lord Morrison of Lambeth used to advocate for public corporations in the early days of political thinking on the question. The new idea would involve far more interference and would inevitably delay still further already long-drawn-out decision processes which control spending. There will no doubt be another airing of the new scheme when a White Paper is published in the spring to give details of each nationalised industry's self-financing target for the next financial year; and the Chancellor of the Exchequer has pronounced himself as having an open mind about it. The supply industry's leaders should lose no time in urging the undesirability of such extra inquiries from the operating aspect: and, indeed, their justifiable irritation at the number of "investigations" to which they are subject.

REGULAR WIRING INSPECTION

Members of the National Inspection Council for Electrical Installation Contracting gathered for their annual meeting last week in the satisfactory knowledge that the number of enrolled contractors is increasing at an accelerating rate. In the current financial year, applications for membership are well ahead of those previously recorded. Rate of progress is geographically patchy, for contractors are frequently persuaded to join because of the decision of local authorities and others controlling large volumes of business to use only approved electrical contractors on their work. In consequence, the decision by a particular county council or the like brings a flood of inquiries from the area concerned. This means a rush of work for the local NIC inspecting engineer, for two full inspections (each of three jobs) is the rule rather than the exception before a small firm is admitted to the NIC roll. Such work inevitably interferes with the routine inspections which should provide a yearly check on how contractors are keeping up their standards. In some areas the result has been an inspection interval nearer 18 months than 12. To bring it back to 12 months might need two more inspecting engineers additional to the one recently appointed. Further, the need for flexibility to meet the uneven incidence of new applications suggests that such extra staff would be more effective if deployed with some second layer of control between headquarters and districts. Perhaps the appointment of senior engineers to control the work load in the north and the south of the country is worth considering. Money is a difficulty, of course. Fees do not cover the cost of NIC activities, the general body of electricity consumers pay, through area boards, contributions representing a little more than ½d/head. But a slight increase on that spending seems justified if the overall results of the NIC are agreed to be worth while.

THE CONVENIENCE OF ELECTRICITY

Electric floor-warming has found some strange bedfellows. From flats to factories, and houses to hospitals, the unseen installations are quietly giving the off-peak load the industry deserves. The South of Scotland Board, which has done so much pioneering in this field, has been looking for new worlds to conquer. It has found one; it is a public convenience at Stirling. Not an ordinary convenience, but one worthy of a Welfare State. The architecture is modern in style, so excellent as perhaps to raise doubts as to the purpose of the building in the mind of an urgent client. Inside, all is electric. Not only is there the automatic floor-warming installation in the Ladies, in the Gents and in a common meeting place, the left-luggage office, but there are ample supplies of electrically heated water also; while for those who pass the class distinction of a coin-operated turnstile, sockets are available for electric shavers. The décor is of the best. This new public asset is centrally situated, significantly, perhaps, near the town hall, a scheduled ancient monument.

Like Clochemerle, Stirling has every reason to be proud of its new progress.

Meteor

This week's quick summary of electrical news faces advertisement page 20

Co-ordination of feeder and transformer protection

by A. Salzmann, Dipl.Ing., A.M.I.E.E.

PROTECTIVE devices for power systems should be regarded as an insurance against the cost of damage to equipment and interruption of supply. Their main task is, therefore, to protect the system from faults and from the effects of faults on the remainder of the network. In the event of a transient fault, the protective relay should operate rapidly and before serious damage occurs, otherwise the fault might develop into a persistent one. Faster operating protective gear will prevent transient faults from becoming persistent. However, on the occurrence of persistent faults—namely, faults which persist regardless of the speed of operation of relays and circuit-breakers—the main task of the latter is to isolate the faulty line section leaving healthy circuits unaffected by fault-plus-load currents.

In power systems with one path between fault and source of supply (radial networks) the circuit-breaker nearest to the fault should open first. In networks with double paths between source and fault, i.e., ring mains (each substation has two in-feeds), both circuit-breakers of the faulty section should operate while those of the healthy circuits should remain stable. This also applies to power systems with multiple paths between source and fault; that is, interconnected networks having complex interconnections forming a number of meshes.

From the above introductory notes it follows that protective requirements are met if the relays (a) disconnect faulty feeders with the minimum of delay and damage to the transmission elements and (b) stability to the remainder of the power system is ensured. Discriminative fault clearance and stability are, therefore, of primary importance. Discrimination secures disconnection of the faulty feeder only, while stability means that healthy line sections remain unaffected by the fault current passing through them. Since discrimination and stability are interrelated, it is essential that improvement of discrimination should not be at the expense of stability and vice versa.

These requirements will be satisfied by employing high speed protective gear, namely relays and circuit-breakers, and by co-ordinating the relay settings of various transmission and distribution elements.

In dealing with the problem of co-ordinating relay settings for medium voltage systems, it is in accordance with modern practice to utilise (a) high speed switched distance protection with stepped time-distance characteristics for transmission lines, (b) induction type time graded overcurrent relays for substation transformers located on the high voltage side or inverse time overcurrent relays located on the low voltage side supplemented by high set instantaneous overcurrent relays placed on the h.v. side, (c) overall biased differential protection for large size transformers and (d) time graded overcurrent relays for distribution networks.

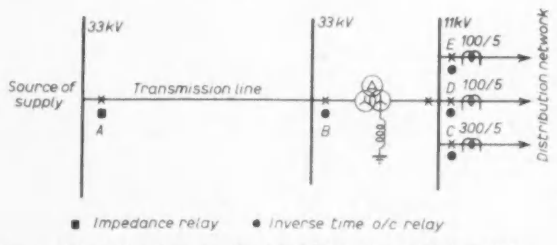

Fig. 1. Single line diagram of tail-end feeder protected by impedance and overcurrent relays

It should, however, be emphasised that difficulties may arise in clearing faults discriminately when different protection methods, such as overcurrent and impedance protection, are applied. Speedy operation of relays nearer to the source of supply (second zone of the impedance relay) cannot be reconciled with the requirement of delayed operation necessary to secure selective operation with transformer overcurrent protection. Discriminative fault clearance can be achieved only at the expense of delayed operation of the impedance relay in its second zone, should the overcurrent relay fail to operate.

Regarding earth fault protection of transmission lines, no co-ordinating problem exists when switched impedance protection is employed. Using a single impedance relay to cope with phase-to-phase and line-to-earth faults, it must provide the same ohmic setting for both types of fault. Co-ordinating of feeder and transformer relaying will also not be required because the zero sequence networks on either side of the transformers are isolated from one another, hence the settings of the relays on the h.v. side are independent of those on the l.v. side. This applies particularly to delta-star or star-tertiary-star connected transformers, the star point of the latter being isolated on the high voltage side.

For example, the impedance relay acting as back-up relay may not respond correctly in the event of a line-to-earth fault on the l.v. side, because the starting relay of the overcurrent type will select wrong voltages. For a delta-star connected unit with ratio $1:\sqrt{3}$, l.v. current distribution 1:0:0 will yield a current distribution 1:0:1 on the h.v. side. Similarly, for a star-tertiary-star connected transformer with transformation ratio 1:1, l.v. current distribution 1:0:0 will cause a distribution $\frac{2}{3}:\frac{1}{3}:\frac{1}{3}$ on the h.v. side.

If arc suppression coils are in use on either side of the transformer, co-ordination of relaying is not required unless earth fault protection is provided for persistent faults only. In this case, grading of the relays is carried out independently on either side.

Radial Networks

For these circuits we apply high-speed impedance protection to transmission feeders, while transformers and distribution circuits are provided with inverse time overcurrent relays of the induction type (Fig. 1). Here the fault current magnitude on the lower voltage side is practically independent of change in generation and the

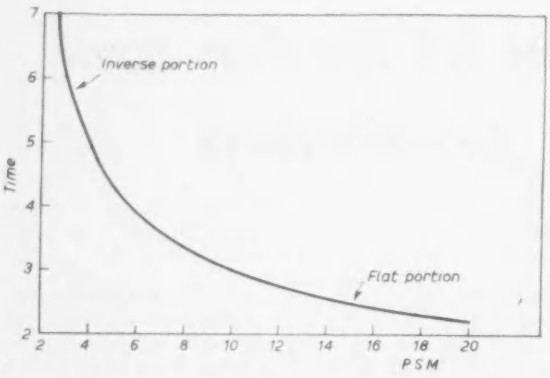

Fig. 2. Graph showing the time-current characteristic of the inverse time-overcurrent relay. Time setting multiplier (TSM)=1·0

inverse portion of the relay time-current characteristic (Fig. 2) is used with advantage to secure discriminative operation between distribution and transformer overcurrent protection. For transmission lines (medium voltage networks) the impedance relay in use is a single-phase unit coping with various type of faults. The maximum distance/impedance to which the relay responds is called the reach of the relay and the latter operates for values below that for which it is set. For transformer feeders, high-speed protection is provided for the total length of the line section as the transformer can be considered as part of the line with both impedances taken together. Transformer faults, on the other hand, are "seen" by the impedance relay in its second zone, acting as back-up relay in the case overcurrent protection fails to operate. Second zone operating time is equal to the time required for the overcurrent relay plus a time allowance, taking into account various errors of the protective devices and tripping time of the circuit-breaker.

In this manner, selective operation based on reach and time between impedance and transformer overcurrent protection can be achieved.

The procedure of co-ordinating the relay settings is as follows:

The first step is to determine the setting of the overcurrent relay for the distribution feeder with the largest current transformer ratio (relay C in Fig. 1).[1] We select the current setting for a given load requirement while the time setting is adjusted to its minimum value. The current setting ranges from 50% to 200% (seven steps) while the time setting is from 0 to 1·0 second in steps of 0·05 second.

With the aid of the standard time-current characteristic (Fig. 2) the relay operating time is determined at maximum time setting (TSM=1·0) for any fault current.[2] The latter can be expressed in terms of multiples of the relay plug setting, one curve being utilised for seven current settings.

The plug setting multiplier (PSM) is given by:

$$PSM=\frac{100F}{R.N.S.} \quad \ldots\ldots\ldots\ldots (1)$$

where F=fault current in amps
R=C.T. ratio
N=relay nominal current
S=percentage relay plug setting.

The CT ratio, fault current and plug setting are, therefore, required to determine the operating time t at a time setting multiplier TSM=1·0 from the relay characteristic.

Any other time setting TSM_x will give an operating time t_x proportional to t_x TSM_x.

Assuming relay C to have a time setting TSM_C and current setting C%, discriminative fault clearance is ensured if the transformer overcurrent relay, B, is set to operate selectively with relay C. Taking into account relay inaccuracy, overswing, current transformer errors and circuit-breaker tripping time t_{pc}, a discriminative time interval between the consecutive relays, B and C, should not be less than t_c plus twice the tripping time t_{pc} of the circuit-breaker C. With the aid of equation 1, the graph (Fig. 2), a given load requirement, current setting and minimum time setting TSM, we can determine the operating time t_c for a three-phase fault close to relay C, the fault location, "F," and minimum short-circuit level at the source of supply.

Thus, the optimum operating time, t_B, of relay B is equal to $(t_c+2\ t_{pc})$ sec, which enables us to determine the time setting TSM_B. Selecting a current setting B% for the transformer, we get PSM_B from equation 1 and, consequently, the operating time t_{B0} from the graph (Fig. 2). The time setting ensuring discriminative fault clearance is, therefore, $TSM_B=t_B/t_{B0}$.

As a further step, we now consider the setting of the impedance relay, A. High-speed protection is applied to the first zone while the second and third zones are set to "see" faults on the transformer and l.v. distribution feeders, and the operating times are to be related to transformer overcurrent protection. Time, t_B, of relay B and tripping time t_{pB} of the circuit-breaker determine $t_{A2}=(t_B+2t_{pB})$ the operating time of relay A in the second zone.

It should be emphasised that the time-distance characteristics of the inverse time overcurrent relays, B and C, are almost linear (graph B and C, Fig. 3) because of the relationship $t=K/I_f$ and $I_f=K_1/D$. In these equations t=time of operation; I_f=fault current; K and K_1=constants and D=distance between relaying point and fault. It follows that the relay operating time is about proportional to the impedance of the transformers and distribution feeders, hence the almost linear characteristic. In Fig. 3 it is shown that the second zone reach (relay A) has to be terminated before graphs A and C intersect to prevent maloperation in the event of a fault at the remote end of the distribution feeder.

As a further illustration, let us consider a practical example (see Fig. 4). A 10 MVA transformer, ratio 33/11 kV, impedance 10%, is fed from one source of supply having a fault capacity 700 MVA. System constant settings of relay B, symmetrical three-phase short-

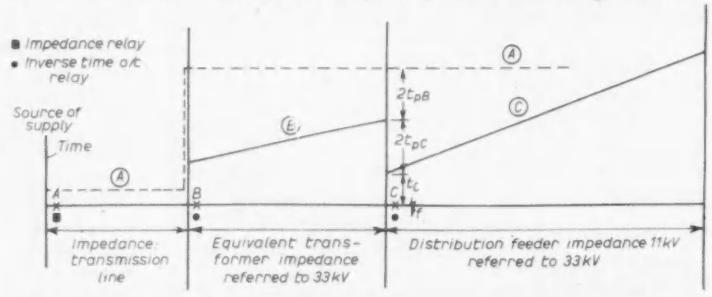

Fig. 3. Time distance characteristic of impedance and inverse time overcurrent relay for circuit shown in Fig. 1. A=characteristic for impedance relay. B=characteristic for transformer o/c relay. C=characteristic for feeder o/c relay

circuit level and impedances corresponding to the mega-volt-amperes based on 10 MVA and 33 kV and expressed in ohms are shown on the diagram. With aid of equation 1 and the graph, Fig. 2, calculated fault currents, time and current settings of relay B, we can determine the operating times, namely, $t_B=0{\cdot}75$ sec; $t_{B1}=0{\cdot}93$ sec; $t_{B2}=1{\cdot}05$ sec; $t_{B3}=1{\cdot}17$ sec; and $t_{B4}=1{\cdot}32$ sec, showing that the time distance characteristic of the inverse time overcurrent relay is almost linear.

An alternative solution of the co-ordinating problem is high-speed transformer protection utilising overcurrent relays placed on the l.v. side. Here the instantaneous zone of the impedance relay "sees" faults within, say, 90% as shown in Fig. 5. The second, and in some cases the third, zone are set to "see" faults on the distribution network and act as a back-up relay for the busbars and outgoing feeder faults.

In this manner, most of the transformer faults are cleared at high speed. However, in the event of an internal fault—say the divertor compartment of the tap changer is involved—the fault cannot be removed by the Buchholz relay but will be cleared by a circuit-breaker remote from the fault. In some cases, high-set instantaneous overcurrent relays located on the h.v. side should be considered as a remedy.

Finally, a few notes on interconnection of power transformers. For star-tertiary-star connected units, back-up protection and first line of defence present no difficulties. The relay will respond correctly to phase-to-phase faults on the lower voltage side since the current distribution on the h.v. side—namely, 1:1:0; 0:1:1; 1:0:1—is identical to that on the l.v. side, assuming 1:1 transformation ratio. For delta-star connected transformers phase-to-phase faults on the l.v. side, say red to yellow current distribution 1:1:0, will yield on the h.v. side current distribution 1:2:1 for a transformation ratio $1:\sqrt{3}$, consequently the impedance starting relays of the overcurrent type will select wrong voltages, causing doubtful operation. The impedance relay will operate correctly if only the h.v. winding is involved. Finally, the use of under-impedance starting relays should be considered as an alternative solution.[3]

Ring Mains and Mesh Connected Networks

For these networks, difficulties may arise in clearing faults discriminately when different protection methods are applied. As an illustration let us consider the network shown in Fig. 6. The application of the graphical method for determining relay settings, illustrated in Fig. 7, will prove useful as reach and time delay can be adjusted

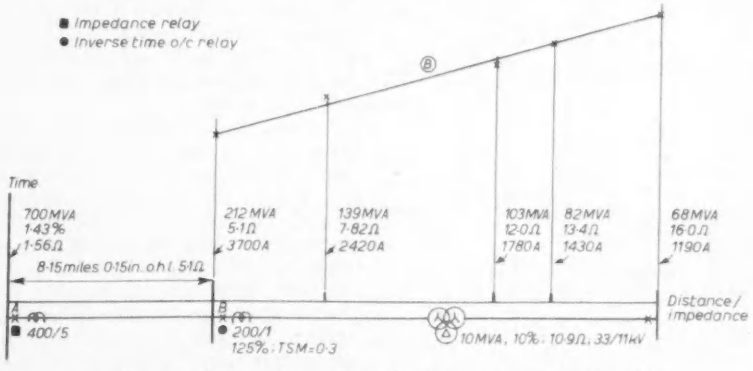

Fig. 4. Time distance characteristic of an inverse time-overcurrent relay

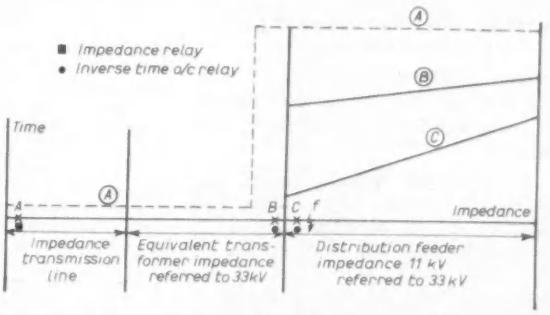

Fig. 5. Time distance characteristic of impedance and inverse time o/c relay for circuit shown in Fig. 1. The o/c relay is placed on the l.v. side

independently. We note that the curves above the base-line represents the characteristics of the relays *a*, *c*, *e* and *g* for power flow in the direction from *a* to *b* and those below the base-line the characteristics for the relays *h*, *f*, *d* and *b* for power flow in the direction from *h* to *g*.

Grading of the impedance relay, first zone, is straight forward. Each relay rapidly measures the distance to the fault occurring within 80% of any line section.

Grading of the second and third zones has to take into account the corresponding zones of the relay protecting adjoining sections. The second zone, say, relay *h*, should be selective with the second zone of relay *f* based on reach. It should be terminate 20% behind the instantaneous zone of relay *f* taking origin A as reference point and assuming that 80% of each line section is provided with high-speed protection.

Similarly, the balance point of the third zone reach relay *h* is 20% behind the second zone of relay *f*, again taking point A as reference. For example, the ohmic setting of relay *h*, second zone, based on reach is obtained by adding to the impedance $Z_{f1}=0{\cdot}8Z_{L3}$ of the first zone relay *f*, the impedance of the total length of section L_4, namely Z_{L4}, and taking 80% of this value. Thus, we get $Z_{h2}=(Z_{L4}+0{\cdot}8Z_{L3})0{\cdot}8$. However, although relay *h* in the second zone has to function selectively with the second zone of the neighbouring relay *f*, based on reach, this relay has to operate discriminately as regards time related to transformer overcurrent protection for unit T_a. This applies to the third zone as well in case the second zone reach does not extend to transformer faults.

In fact, transformers should be considered as teed feeders. For a fault, f_{L3}, the directional impedance relays *g* and *f* remain inoperative and the fault appears to the relay, *h*, as being further away than it actually is. The voltage applied to relay *h* (assuming a high short-circuit level at the source of supply) is equal to $V_h=I_hZ_{L4}+(I_h+I_a)Z_a$ and the impedance appears to the relay as:

$$V_h/I_h=Z_{L4}+(I_1/I_h)Z_a \quad \ldots\ldots(2)$$

The latter, therefore, measures an impedance larger than the true impedance $(Z_{L4}+Z_a)$, since current I_h is smaller than the total fault current I_1.

It follows that the relay under-reaches as the fault appears further away than it actually is and the second zone reach must be adjusted to act as a back-up relay in the event of transformer overcurrent protection failing to operate, or, alternatively,

the relay will protect a smaller portion of the transformer.

The third zone ohmic setting is also based on time and reach, which should be related to the longest adjacent line section.

As a further illustration of co-ordinating feeder and transformer relaying, let us consider relay *a*. It is obvious that the second zone of the latter must be related to the operating time of the transformer overcurrent relay *i*. The time setting for relay *i* is determined in the manner already outlined. The optimum time setting TSM_i is obtained with maximum short-circuit level at the source of supply for a three-phase short-circuit, namely, close-up fault f_1 on the distribution feeder l_1 and only one transformer in circuit (Fig. 6). A fault, f_{L2}, occurring on transformer T_b, and assuming minimum short-circuit level at the source of supply corresponding to an impedance equal to the second zone reach of relay *a* will cause overcurrent relay *i* to operate t_{io} secs as determined from the graph in Fig. 2. Thus, the optimum operating time of relay *i* is equal to $t_i = t_{io}$ TSM_i and the second zone operating time of the impedance relay *a* should not be less than $t_{a2} = (t_i + 2\ t_{pa})$ where t_{pa} represents the tripping time of the circuit-breaker *a*. Ignoring the underreaching effect, the ohmic setting of the second zone is, therefore, $Z_{a2} = Z_{L1} + Z_b$.

However, when taking into account underreaching tendency, the point of balance (second zone reach) must be nearer to the busbars B for a fault on the transformer than for a fault on line section L_2. This follows from the second equation above. Thus, a fault, f_{L2}, on unit T_b may not be "seen" by the impedance relay *a* in its second zone. The latter remains idle if relay *i* fails to operate while the corresponding fault f_{L2}' on line section L_2 will be "seen" by the relay in its second zone. Thus, with settings Z_{a2}(ohms), relay *a* protects a smaller portion of the transformer equivalent to $(Z_{a2} - Z_{L1})/(I_1'/I_a')$ohms where I_1' and I_a' are fault currents corresponding to the nearest fault (location f_{L2}') on unit T_b. Relay *a* will measure the impedance according to the equation (2).

$$Z_{a2} = Z_{L1} + [Z_b/(I_1'/I_a')]I_1/I_a \text{ ohms}$$

since ratios I_1'/I_a' and I_1/I_a are approximately identical (see example).

Table I. System Constants

Line Transformer Feeder	Relay	Type of Relay	Line length, Transformer, Feeder data	(a) Imped. Ohms	(b) Imped. %	(c) Imped. Ohms	C.T. Ratio	P.T. Ratio	Transformation Ratio 400/5 . 110/33000
L_1	a.b.	Imped	10 ml. 0·15″	5·6	5·15	1·48	400/5	33000/110	0·266
L_2	c.d.	Imped	12 ml. 0·15″	7·5	6·90	2·00	400/5	33000/110	0·266
L_3	e.f.	Imped	4 ml. 0·15″	2·5	2·30	0·62	400/5	33000/110	0·266
L_4	g.h.	Imped	4 ml. 0·15″	2·5	2·30	0·62	400/5	33000/110	0·266
T_a	k	o/c	10MVA,10%	10·9	10·00	2·90	200/1	—	—
T_b	i	o/c	5MVA, 8%	17·4	16·00	4·62	100/1	—	—
T_c	i	o/c	5MVA, 8%	17·4	16·00	4·62	100/1	—	—
l_1	j	o/c	6 ml. 0·10″	38·7	35·30	10·4	300/5	—	—
l_2	l	o/c	7 ml. 0·10″	45·55	42·00	12·4	300/5	—	—

(a) Referred to 33 kV. (b) Referred to 10 MVA base and 33 kV.
(c) "Seen" by impedance relays.

However, if the length of the line section is short, it is possible that the impedance relay might not "see" a transformer fault at all in its second zone.

Regarding third zone setting Z_{a3}, the reach should be terminated as outlined earlier, that is, 20% behind the second zone relay *c*, taking point A as reference. However, since the operating time of relay *e* in its second zone has to be related to the time t_k of overcurrent relay *k*, the operating times t_{e2}, t_{c3} and t_{a3} have to be increased accordingly, as shown in Fig. 7, and adjustment of third zone setting, Z_{a3}, in regard to time and reach are made without jeopardising the discriminative fault clearance.

It should be noted from Fig. 7 that the ohmic settings for relays *a, c, h* and *f* have their limitation by reason of the requirement of discriminative relay operation based on reach. In some cases it is unlikely that these relays will "see" transformer faults particularly for short line sections and if underreach is to be taken into account. In this case, third zone protection will clear transformer faults but at the expense of delayed operation should the transformer overcurrent relay fail to operate.

Relays *d* and *e* in the second and third zone reaches are not limited because co-ordination of ohmic settings related to adjacent line sections is not required. These relays are permitted to "see" faults up to the remote end of distribution feeders in their second, and possibly in their third zones, provided their operating times exceed t_j and t_l for faults at the remote end of the 11 kV feeders with minimum short-circuit level at the source of supply. The impedances of this feeder appears to the relay as nine times its actual value $[(33/11)^2]$. If the relays are set to "see" faults at the remote end of the distribution feeder, selective operation between impedance and distribution overcurrent protection, based on time, must be ensured.

Finally, an alternative solution is to place the transformer overcurrent relay on the l.v. side with the object (a) of using impedance protection as first line defence for certain type of faults, (b) shorten the fault clearance time and (c) using the third zone as back-up protection as shown in Fig. 8. However, for ring mains consisting of short line sections, the impedance relay is not likely to "see" transformer faults in its second zone,

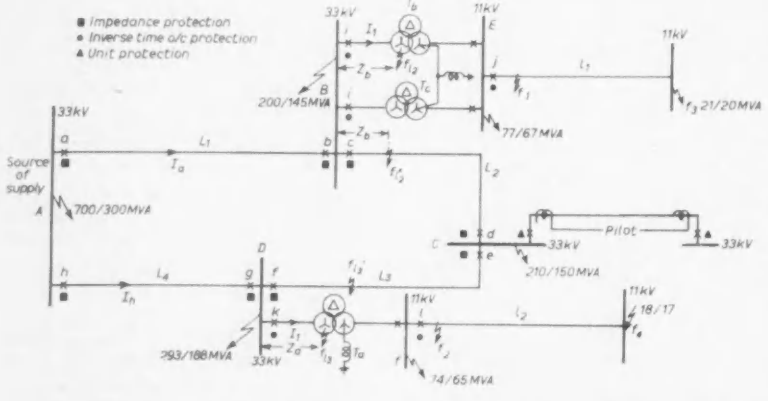

Fig. 6. Single line diagram of a 3 kV ring main system incorporating impedance protection

Table 2. Relay Settings

Ref	Relay	(a) Line section impedances ohms/cond. ref. 33 kV	(c) Impedance, ohms, "seen" by the impedance relays	Secy. imped. of zones			Tripping time of zones			Overcurrent relay settings	
				Z_1 ohms	Z_2 ohms	Z_3 ohms	t_1 secs	t_2 secs	t_3 secs	time	current %
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	a	5·60	1·48	1·19	2·48	3·08	0·10	1·18	2·90	—	—
2	b	5·60	1·48	1·48	1·48	1·48	0·10	0·10	0·10	—	—
3	c	7·50	2·00	1·60	2·01	3·30	0·10	0·60	2·40	—	—
4	d	7·50	2·00	1·60	20·6	20·6	0·10	1·24	1·24	—	—
5	e	2·50	0·62	0·50	15·7	15·7	0·10	1·90	1·90	—	—
6	f	2·50	0·62	0·50	1·78	3·28	0·10	0·60	1·74	—	—
7	g	2·50	0·62	0·62	0·62	0·62	0·10	0·10	0·10	—	—
8	h	2·50	0·62	0·50	0·89	1·92	0·10	0·60	1·57	—	—
9	i	17·40*	4·62	—	—	—	—	—	—	0·20	125
10	j	38·70	10·40	—	—	—	—	—	—	0·10	50
11	k	10·90	2·90	—	—	—	—	—	—	0·314	125
12	l	45·55	12·40	—	—	—	—	—	—	0·10	50

Key. 2/10/10 = Table 2, Line 10, Col. 10. * Transformer impedance

the unit being removed from the network, after a time delay, by third zone protection. High-set instantaneous overcurrent relays placed on the h.v. side may be regarded as remedy.

A Practical Example

Let us consider the 33 kV ring main shown in Fig. 6, having one in-feed and supplying substations B, C and D. The outgoing feeder from substation C is provided with unit protection, substation B supplies two transformers, T_b and T_c, each rated at 5 MVA and operating in parallel, and station D supplies one unit, T_a, rated at 10 MVA. These star-tertiary-star connected units are provided with overcurrent protection. Other protective devices are incorporated in the circuit, such as Buchholz, winding temperature and tertiary overcurrent relays, acting as stand-by earth fault protection for distribution feeders.

Switched impedance protection is utilised for the 33 kV ring main and operation is initiated by starting relays of the overcurrent type. System constants are given in Table 1, while symmetrical three-phase short-circuit levels maximum and minimum values are shown in Fig. 6.

It is required to co-ordinate transmission and transformer relaying for (a) *Transformer overcurrent relays placed on the primary side and* (b) *Transformer overcurrent relays placed on the lower voltage side.*

The first step is to co-ordinate distribution and transformer overcurrent protection. For a given load requirement we select current settings while the time settings for relays j and l are adjusted to the minimum values. (See Table 2, 10/10; 10/11; 12/10; 12/11.) Relay i placed on the h.v. side must be set to discriminate with j and l with k, the latter being placed as well on the h.v. side. Selecting for relay i a current setting of 125%, we can determine the optimum time setting, TSM_i, as outlined earlier with maximum short-circuit level at A, one unit, T_c, removed from circuit and a close-up fault at f_1. Similarly, TSM_k is determined for a close-up fault at f_2 (see 9/10; 9/11; 11/10; 11/11). These values will yield operating times t_i=0·74 sec and t_k= 0·72 sec.

The second step is to co-ordinate transmission line and transformer overcurrent protection. Starting with relay b in anticlockwise direction the settings are as follows:

Relay b: Total line section is protected at high speed;

t_{b1}=0·1 sec;

$Z_{b1}=Z_{L1}$=1·48 ohms (2/4; 2/7);

$t_{b2}=t_{b3}$=0·1 sec;

$Z_{b2}=Z_{b3}$=1·48 ohms (2/8; 2/9; 2/5; 2/6).

Relay d: First zone:

t_{d1}=0·1 sec;

Z_{d1}=0·8Z_{L2}=1·6 ohms (4/4; 4/7).

Second and third zones: The relay is set to "see" faults on units T_b, T_c and distribution feeder 1. Ohmic setting:

$$Z_{d2}=Z_{d3}=[Z_{L2}+17\cdot4/2+Z_{L1}\,(33/11)^2]\,0\cdot266=20\cdot6 \text{ ohms (4/5; 4/6).}$$

Operating time:

$t_{d2}=t_{d3}$.

The second zone is set to discriminate with transformer overcurrent protection, hence:

$$t_{d2}=t_{d3}=t_l+2_xt_{pd}=0\cdot74+0\cdot5=1\cdot24 \text{ sec (4/8; 4/9).}$$

It will be noted that the reach of the impedance relay is extended into the distribution network. In this case, the operating time of relay j (2_j secs) for a fault f_3 with minimum short-circuit level at the generating station must be considerably lower than t_{d2}.

Relay f: First zone:

t_{f1}=0·1 sec;

Z_{f1}=0·8Z_{L3}=0·5 ohms (6/4; 6/7).

Second zone:

$Z_{f2}=(0\cdot8Z_{L2}+Z_{L3})0\cdot8$=1·78 ohms;

$t_{f2}=0\cdot1+2t_{pf}$=0·6 sec (6/5; 6/8).

Third zone:

$Z_{f3}=(Z_{L1}+Z_{L2}+Z_{L3})\,0\cdot8$=3·28 ohms;

$t_{f3}=t_{d2}+2t_{pf}$=1·74 sec (6/6; 6/9.

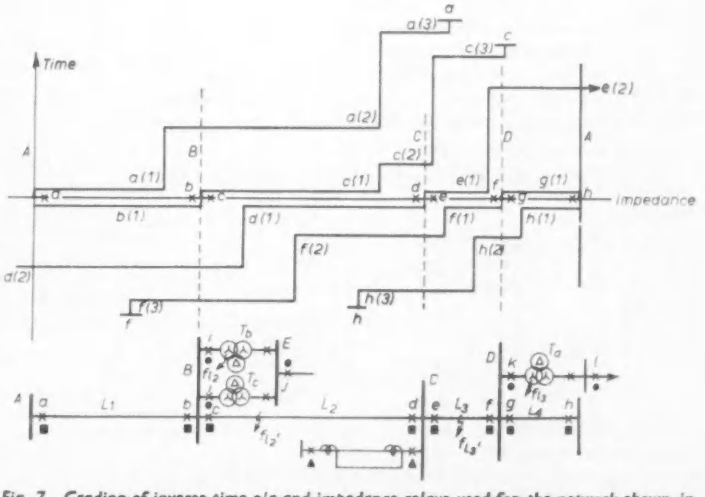

Fig. 7. Grading of inverse time o/c and impedance relays used for the network shown in Fig. 6. The o/c relay is placed on the high voltage side

Relay h: First zone:

$t_{h1}=0{\cdot}1$ sec;

$Z_{h1}=0{\cdot}8Z_{L4}$

$=0{\cdot}5$ ohms (8/4; 8/7).

Second zone: ohmic setting:

$Z_{h2}=(0{\cdot}8Z_{L3}+Z_{L4})\ 0{\cdot}8$

$=0{\cdot}89$ ohms referred to 33 kV side

$Z_{h2}=0{\cdot}89/0{\cdot}266$

$=3{\cdot}37$ ohms where 0·266 is the transformation ratio CT/PT= (400/5) (110/33,000).

It follows an impedance larger than $(3{\cdot}37-Z_{L4})=0{\cdot}87$ ohms will not be "seen" by the relay *h* and, if the underreach effect is taken into account, the impedance relay remains idle in its second zone for transformer faults. It is, therefore, not required to relate the operating time t_{h2} to overcurrent protection.

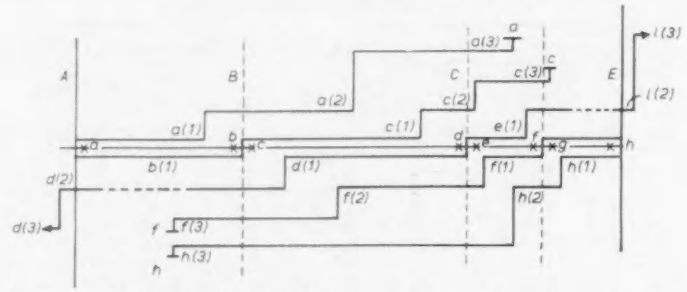

Fig. 8 Grading of inverse time o/c and impedance relays used for network shown in Fig. 6. O/c relay is placed on the low voltage side

Operating time:

$t_{h2}=0{\cdot}1+2t_{ph}$

$=0{\cdot}6$ sec (8/8).

Third zone:

$Z_{h3}=[(0{\cdot}8Z_{L3}+Z_{L3})\ 0{\cdot}8+Z_{L4}]\ \text{x}\ 0{\cdot}8$

$=1{\cdot}92$ ohms (8/6) referred to 33 kV side.

$Z_{h3}=1{\cdot}92/0{\cdot}266$

$=7{\cdot}2$ ohms and the relay will "see" a transformer fault (location F_{L3}) corresponding to $(7{\cdot}2-Z_{L4})$

$=4{\cdot}7$ ohms referred to the secondary side $4{\cdot}7\times0{\cdot}266$

$=1{\cdot}25$ ohms or 4·32% based on 10 MVA.

Operating time t_{h3} is related to overcurrent relay *k* for a fault at f_{L3} and minimum short-circuit level at A we obtain fault currents $I_h=1560$A; $I_1=1810$A and $I_1/I_h=1{\cdot}16$. Accordingly we get $PSM_k=[1810/200/1]/(100/125)=7{\cdot}3$ giving the operating time for relay *k* from Fig. 2 as 3·4 sec. Hence the actual operating time $t_k=3{\cdot}4$;

$TSM_k=3{\cdot}4\times0{\cdot}314$

$=1{\cdot}07$ sec

and third zone setting $t_{h3}=1{\cdot}07+2t_{ph}$

$=1{\cdot}07+0{\cdot}5$

$=1{\cdot}57$ sec (8/9).

In fact with third zone setting $Z_{h3}=1{\cdot}92$ ohms and $t_{h3}=1{\cdot}57$ sec, a fault located at f_{L3} will cause relay *h* to underreach and remain idle.

In a similar manner we can determine the settings for the relays *a, c, d, e, f* and *g* in clockwise direction. These values are listed in table 2.

Finally let us consider co-ordinating feeder and transformer relaying, assuming that transformer overcurrent relays *i* and *k* are placed on the lower voltage side. Grading of relays is carried out as in Fig. 8. Compared with Fig. 7 we notice the operating time of the impedance relays is considerably reduced.

For instance, the settings for relay *e* are derived as follows:

First zone:

$t_{e1}=0{\cdot}1$ sec;

$Z_{e1}=0{\cdot}8\times0{\cdot}62$

$=0{\cdot}5$ohms.

Second zone:

$t_{e2}=t_{e1}+2t_{pe}$

$=0{\cdot}6$ sec;

$Z_{e2}=0{\cdot}62+0{\cdot}8\times10{\cdot}9\times0{\cdot}266$

$=2{\cdot}32$ ohms.

Third zone: Here we can force the relay to see faults on distribution feeders:

$Z_{e3}=0{\cdot}62+(10{\cdot}9\times0{\cdot}266)+[5{\cdot}05\ (33/11)^2]\ 0{\cdot}266$

$=15{\cdot}7$ ohms.

It is obvious the operating time t_{e3} must be related to the overcurrent protection. For an optimum operating time $t_k=1{\cdot}4$ sec (see Fig. 6 fault f_2) we get

$t_{e3}=t_k+2t_{pe}$

$=1{\cdot}4+0{\cdot}5$

$=1{\cdot}9$ sec.

In a similar manner we can determine the settings for the remainder of the relays.

Conclusion

Co-ordination of feeder and transformer relaying can be achieved if the ohmic settings of the impedance relays protecting transmission lines are based on reach related to adjacent line sections, while time settings of the second and third zone are related to the optimum operating time of transformer overcurrent relays.

Dealing with ring mains, substation transformers should be considered as teed-feeders. It is essential to take into account the underreach effects of the impedance relay particularly if small capacity transformers and short line sections are involved.

When placing transformer overcurrent relays on the l.v. side the operating time of the impedance relay can be shortened considerably but the latter is to be regarded as a device for first line of defence. Faults in the diverter compartment of the tap-change transformer are cleared at distance from the substation unless high set instantaneous overcurrent relays are incorporated in the transformer circuit and on the primary side.

Regarding back-up protection for distribution networks, impedance relays associated with delta-star connected transformers may fail to operate correctly. This is due to dissimilar current distribution on the l.v. and h.v. sides in the event of line-to-line and line-to-earth faults on the lower voltage side and operation of the relay initiated by starting relays of the overcurrent type. Doubtful operation should not be ruled out as the starting relays may select wrong voltages. The impedance relays will operate correctly only if faulty h.v. windings are involved. However, for star-tertiary-star transformers, back-up protection for line-to-line faults on the l.v. side will not present difficulties since current distribution on the l.v. and h.v. sides is identical. This does not apply to line-to-earth faults. If arc suppression coils are used on the l.v. side, no back-up protection problems will arise. Finally, the use of under-impedance starting relays should be considered as an alternative solution.

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Variable speed induction motors

UNORTHODOX "POLE STRETCHING" TECHNIQUE USED

TWO more machines have been added to the series of variable-speed induction motors developed at the University of Manchester. Last week, Dr E. R. Laithwaite described the operation of motors operating on what has been called the "pole stretching" principle.*

The synchronous speed of an induction motor for a supply of constant frequency depends on the phase displacement between currents in adjacent stator slots and also on the physical spacing of the stator slots. If either or both quantities are varied, the synchronous speed will change. The authors previously described a spherical rotor induction motor in which speed was changed by angling stator blocks. This effectively altered the spacing between stator slots in the direction of rotation.

"Pole Stretching"

The two new motors maintain the physical spacing of the stator slots, but vary the phase displacement between currents in adjacent slots. This technique has been christened by the authors "pole stretching." The Logmotor was the first motor described. It has uniformly spaced rotor and stator slots, but the conductor in each stator slot is energised from a distinct phase of a multi-phase supply. For a given speed change, the phase displacements between currents in all the stator slots are changed by the same increment. This change in phase displacement is achieved by energising the motor stator winding from a specially designed phase-shift transformer having a multi-phase secondary winding.

A multi-phase supply can be obtained from phase-shifter which is similar in construction to a squirrel-cage motor. If one end ring of a squirrel-cage rotor winding is removed and the rotor is locked, applying a three-phase supply to the stator will induce multi-phase e.m.f's in the rotor bars, and the number of phases will be equal to the number of rotor bars. Displacing the rotor with respect to the stator will not alter the phase displacement between rotor phases, but only in relation to the stator phases. However, if a logarithmic distribution is used for the stator and rotor windings, the phase displacements between rotor slot e.m.f's will vary uniformly as the rotor is turned.

One way of obtaining the logarithmic winding is shown in Fig. 2. A conventional stator winding is used for the phase-shifter primary, but it is spaced logarithmically in the slots. Thus, the phase increment between adjacent slot currents is constant, in this case 18°, but the pole pitch decreases from left to right. With the secondary (rotor) winding in the position (b), its slots correspond with those in the primary and, provided magnetic coupling is good, the e.m.f's in secondary adjacent phases will also be displaced by 18°. The effect of moving the secondary to position (c), where bar 20 is now opposite primary slot 10, is comparable with relative movement of the C and D scales on a slide rule. If overlap is ignored, any 20 bars in the secondary now span 10 of the primary slots and the incremental phase change between adjacent secondary winding e.m.f's is now 9° instead of 18°. Displacement in the opposite direction would result in a secondary e.m.f. displacement between bars of 36°. It will be noted that the change is uniform for all secondary slots and is continuous with rotor movement.

Connection to Motor

If the phase-shifter secondary output is now connected to the motor stator winding, the required change in phase displacement between adjacent slot currents to give a change in speed may be obtained by turning the induction regulator primary. Interconnections between secondary and motor stator are required to convert a logarithmic phase distribution to a linear one.

It is possible to use a uniformly slotted construction for the phase-shifter primary, but to so interconnect the three primary phases that the logarithmic distribution is obtained, and such a winding is described in the paper.

This is the principle called by the authors "phase stretching." It will be noted that the number of output points or phases varies with the overlap of the phase-shifter primary and secondary windings and also that the total phase rotation may not be 360°.

Limitations of Design

There are two important limitations to the method. The first applies to the phase-shifter, for if the primary and secondary are cylindrical and not flat as shown in the development diagram, rotation to position (c) causes that part of the primary from slots 50 to 80 to overlap the secondary slots 10 to 20.

This will mean that part of the motor stator winding will have phase displacements between currents in adjacent slots other than that desired for the speed selected. The speed at which the motor runs will then be determined by the relative magnitude of the desired and unwanted

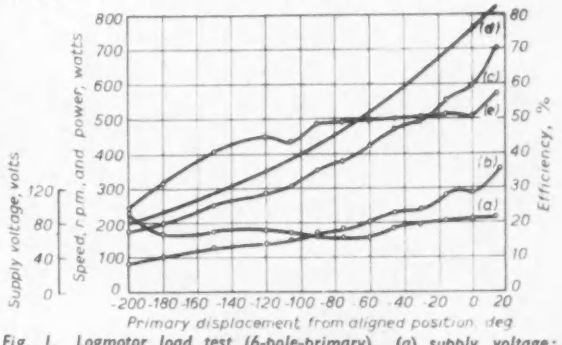


Fig. 1. Logmotor load test (6-pole-primary). (a) supply voltage; (b) output power; (c) speed for maximum efficiency; (d) calculated synchronous speed; (e) efficiency

*Paper 3149: "The Logmotor—a Cylindrical Brushless Variable-speed Induction Motor"; Paper 3262: "Brushless Variable-speed Induction Motor Using Phase-shift Control." By Prof F. C. Williams, O.B.E., D.SC., D.PHIL., F.R.S. MEMBER; E. R. Laithwaite, M.SC., PH.D., A.M.I.E.E.; J. F. Eastham, M.SC.; W. Farrer, M.SC. GRADUATE and L. S. Piggott, M.SC., A.M.I.E.E.

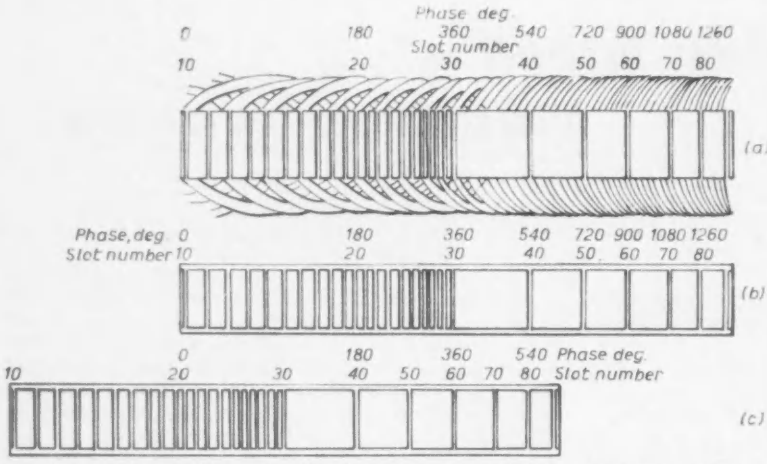


Fig. 2. The principle of phase stretching shown for a developed winding. (a) primary winding; (b) secondary winding; (c) secondary after displacement

magnetic fields. This effect can be reduced by disconnecting secondary coils on the induction regulator overlapped by the primary. The second limitation applies to the motor and is a feature common to all machines where a fractional pole system is used. The motor tends to run at speeds corresponding to an even number of poles. The effect is due to flux "carried over" from the end of the energised part of the stator block to the beginning of the block. It can be overcome by destroying the rotor flux between exit from the trailing edge of the stator block and entry to the leading edge. Additional short-circuited rotor bars added to the stator can reduce the flux "carried over" and improve the speed-phase displacement characteristic, but at the expense of increased losses.

Logmotor Performance

The performance of a small Logmotor constructed by the authors is shown in Fig. 1. Efficiency is low, only about 50% between the speeds of 350 r.p.m. and 700 r.p.m. due to high copper and iron losses. It is thought that these could be reduced considerably by improved design. Peak efficiency occurred at about 20% slip and the motor did not exhibit tendencies to develop crawling torques.

The authors conclude that the experimental machine has proved the principle of "phase stretching" as a method of speed control to be practicable, provided the stator has a break to ensure that the rotor flux in any tooth is destroyed once every revolution. The logarithmic motor has nearly all its stator block available for use, in contrast to the spherical rotor machine.

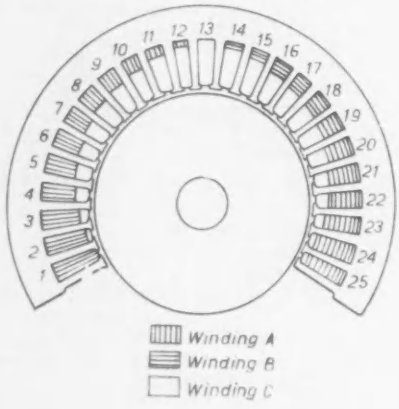


Fig. 3. Arrangement of stator windings in a pole stretching motor for feeding from two 3-phase phase-shifters

Phase-shift Control

The second type of motor described by Dr Laithwaite also obtained its speed variation by varying the phase increment per slot of stator current. But instead of a specially designed phase shifting transformer, two ordinary phase-shifting units were used. The motor had a gapped stator with uniformly spaced slots and three 3-phase stator windings. The windings were disposed in the slots as shown in Fig. 3. Winding C was a 3-phase winding energised from the mains, and in series with both primary windings of the phase-shifting transformers. Each 3-phase secondary of the phase-shifting transformers energised one of the remaining windings on the motor stator. The two phase-shifting transformers were ganged so that they retarded and advanced the phase of their winding currents by the same angle. The combined effects of the currents in the three stator windings produced a varying number of stator poles when the phase-shifter settings were changed.

If the short stator machine had n poles, the output was limited to n times the rotor copper loss. This limited the speed range practicable. Speed range was also limited to 2: 1 when only two phase-shifters were used, but it would be theoretically possible to obtain a wider speed range by using a more complex winding with more than two phase-shifting transformers.

Tests on an experimental machine fed from two phase-shifters showed that speed control with constant efficiency, could be obtained over a speed range of 1·5:1. The motor efficiency obtained was about 66%. Provided the associated phase-shifters were matched with the motor characteristics, overall efficiencies of 62% were considered possible by the authors. The characteristics of the phase-shift control motor, in common with the spherical rotor motor, seemed more suited to a constant power characteristic, but its power/weight ratio would probably be lower than that of the spherical motor.

A conventional mechanical construction was used and windings on both motor and phase-shifters were conventional except for grading of turns. The principal of the phase-shift motor could be applied to construct a motor giving a number of discrete speeds over a given range, instead of a continuous variation of speed. The motor required a similar winding to that shown in Fig. 3, but phase-shifting could be effected simply by switching and no phase-shifting transformers were required.

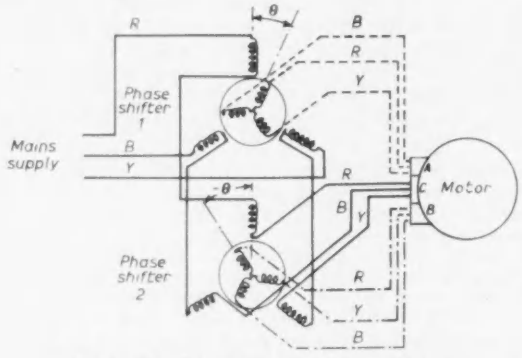


Fig. 4. Connection of motor and phase-shifters

DISCUSSION

The discussion was opened by MR C. C. INGLIS (BTC), who complimented the authors on challenging some past concepts of motor design. He asked whether the motors were reversible. MR A. S. M. ASHWORTH (AEI), asked if there was a lower limit to the practicable h.p. rating of the new motors since the spherical motor was not considered a proposition below a rating of 50 h.p. He also suggested that some difficulties might be encountered in meeting conflicting requirements of numbers of conductors and voltage applied.

PROFESSOR RAWCLIFFE (Bristol University) preferred the phase shift motor to the logmotor. He though the next step would be to find a means of making available energy lost through having to destroy rotor flux "carried over." He thought the authors too anxious to dispose of brushes and suggested that constant current supply was not a realistic way of specifying performance.

MR J. S. HOLMES (Rotax) referred to development work on the spherical rotor motor by the aircraft industry. It was at one time thought that this type of machine, operating as an induction generator, could be used to derive a constant frequency supply when driven over the characteristic 2:1 speed range of an aero engine. However, it had been shown that the power/weight ratio was only about half that of a hydraulic drive. The calculations were based on a 40 kVA machine.

MR W. HILL (AEI) took the authors to task for not giving more attention to the economics of machine design and called for a more realistic treatment of this aspect of design in university courses and text books. MR R. D. BALL (English Electric) asked if the authors had considered applying their principles to a hysteresis permanent magnet type of motor running synchronously. He also suggested that a linear motor working on a similar principle to those described might be applicable to planer drives.

In reply, PROF WILLIAMS, and DR LAITHWAITE said although both types of motor were reversible by interchanging two supply phases, it was probable that the logmotor would have a preferred direction of rotation. The difficulty of marrying number of turns required with applied voltage mentioned by Mr Ashworth could be resolved by using an auxiliary transformer. The authors, replying to Professor Rawcliffe, pointed out that the whole object of their research programme had been to design brushless motors. It seemed probable that any attempt to make use of rotor "carried over" power would only result in larger losses. In reply to Mr Ball, the authors said they had considered development of the hysteresis motor. Application of the principle to planer drives was likely to be restricted by the speed requirements. Dr Laithwaite was critical of the basis on which the power/weight ratios mentioned by Mr Holmes were calculated.

15 MW gas turbine alternator for peak power

ALMOST a year ago the South Western Electricity Board brought into service the first of two 3 MW gas turbine-driven generators to meet peak load requirements in north Devon. This week the CEGB announce their intention to place a £200,000 order with Bristol Siddeley for a 15 MW gas turbine-driven generator. The generator installation is to be located at Hams Hall, near Birmingham.

The plant is scheduled for commissioning in September, 1962. It will enable the CEGB to assess the performance of gas turbines, developed from their aircraft counterparts, for meeting peak-load and emergency requirements.

Gas Turbine Unit

The prime mover to be used is based on the Bristol Siddeley "Olympus" turbo-jet engine. It will consist of a gas generator and a free power turbine. The gas generator employs compound axial flow compressors individually driven by separate turbines in conjunction with an annular combustion chamber containing a group of separate flame tubes.

The free power turbine is separate from the gas generator, but directly coupled to the alternator. It converts energy in the gas effluent from the gas generator into shaft output power.

Turbine Characteristics

Gas turbines have a low thermal inertia characteristic which is well suited to quick starting and rapid loading. They can be readily adapted for automatic control and, in fact, both the 3 MW sets installed by the South Western Board are remotely controlled from the Bristol headquarters.

The turbine unit is small, compact and light as instanced by an overall length of 52·5 ft and a total weight of 11 tons, which compares favourably with the generator weight of 60 tons. Fuel consumption is also claimed to be economical and is estimated to be 0·752 lb/kWh. Oil consumption will be 1·5 pints/hr.

The light weight and compact construction of the gas turbine unit means that the building housing it can be relatively small and also that the foundations can be less substantial than for a steam plant.

The associated alternator will be constructed by Brush Electrical Engineering Co. The rating will be 25 MVA at 11 kV. The alternator will run at 3,000 r.p.m. and will have protective stator winding thermocouples.

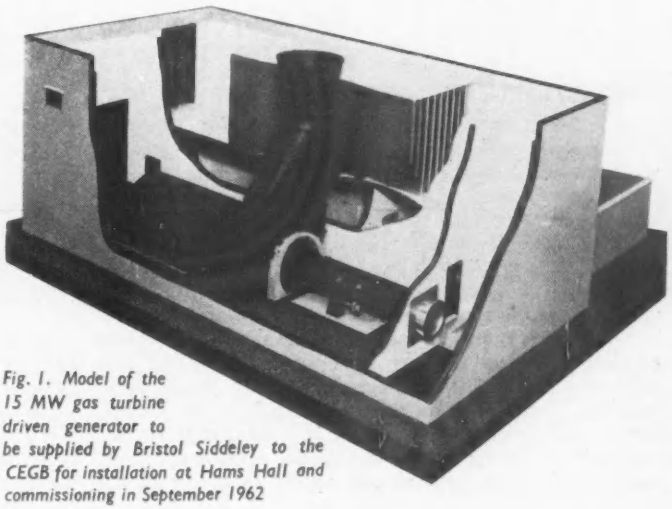


Fig. 1. Model of the 15 MW gas turbine driven generator to be supplied by Bristol Siddeley to the CEGB for installation at Hams Hall and commissioning in September 1962

NOTES ON WIRING

BY MEGOHM

THIS week I paid a visit to the offices and demonstration rooms of the original manufacturer of mineral-insulated copper-sheathed cables. I always consider that an hour or two at these offices keeps me up to date in this field of wiring and also provides me with information about the engineers who use this cable and those who are, at last, finding out its qualities. All the latest improvements and tools are clearly and politely demonstrated, although the cable is, if you will excuse my twisted sense of humour, "stuck up"! Greater use is being made of gum and/or glue for this purpose and results are, I understand, satisfactory. A 19-core cable is on show and this should prove useful to many engineers.

Two new tools were shown to me and these should prove most valuable to the site operative. One tool has been perfected to assist in the application of the screw-on pots and, although simple in design, does a really sound job. The second tool is a stripping tool which speeds up the removal of the copper sheath. Available in two sizes, the tool has a cutter blade made of high carbon tool steel and capable of stripping 2,500 yards of copper sheath without needing to be reground.

Of course, this manufacturer does not stop at his own wares. Also on show were conduit boxes, switchgear and lighting fittings to illustrate the methods of entry, etc., for m.i.c.s cable. I was particularly interested in a new line of conduit boxes which have been designed specifically for use with m.i.c.s. cables. Special attention has been paid to the finish of these boxes and, after careful research, the manufacturer chose "Sherardising" as the real answer. This finish, it is claimed, offers good corrosion resistance, complete coverage of uniform thickness and perfect electrical conductivity. It is interesting to note that the clip grip on the boxes secures the *pot seal* and not the cable as do certain other makes of boxes. Included in the range is a circular looping-in box, one inch in depth. This range, in my opinion, is about the best I have seen for use with m.i.c.s. cables.

Altogether, a pleasant and satisfying visit and, as always, I gained knowledge as well as having refreshed my memory.

Fuses

My comments under the above heading in the ELECTRICAL TIMES, 3 November, 1960, did not, it appears, go unnoticed. Not long after I read the printed version, I had on my desk, via the Editor, a sample of a line marketed by a firm well known for their accessories and rubber-moulded holders, etc. This line consists of a neat card with four cartridge fuses (2 A, 5 A, 10 A, 13 A) held in a transparent cover. Printed on the card is a list of apparatus which should be served by the various fuses. The 2 A size is shown as being suitable for apparatus such as clocks, vacuum cleaners, radio or TV, etc., and the other three sizes have similar information under their headings. The cost of this card and fuses is 2s and it even has a small hole already punched in it so that it can be hung adjacent to the fuseboard position. Apparently, these cards sell in large numbers and appear to me to be an ideal guide to the ordinary householder who is not versed in the matter of fuses. I have already included in a specification, for half a dozen such cards to be supplied, and intend to continue the idea.

I gathered that the firm concerned agreed with my previous observations on the matter of plugs being sold with fuses fitted of incorrect size, despite the purchaser informing the seller of the particular piece of apparatus intended to be connected to the plug. Their representatives had also had some trouble in trying to convince chain stores to stop selling the glass type fuse for use in plugs, and it seems that the people concerned just ignored any good advice given. These cards of fuses had been designed to deal with such people and I trust that the idea has been successful.

As a matter of interest, I presented one of these cards to each of my two friends who allowed me to examine their plugs and both were really delighted at getting such guidance and in such an attractive finish. I feel that this type of thing should be encouraged by contractors and retailers in an effort to educate the householder.

Sealing Conduits

I was interested in the recent correspondence in the Problems and Practice columns of the various methods used to prevent the ingress of dirt and plaster, etc., into conduits. Corks and wooden plugs were mentioned, but from what I have seen on sites the most common method is to push a piece of paper into the box and trust to luck. At times a rolled-up piece of paper is pushed into the mouth of the conduit, but neither of these methods is really effective. A plasterer is never happier than when he has gallons of water everywhere and his wet brush is generally used with great gusto. Consequently, the paper in the box becomes gradually saturated and often breaks up, with the result that the sodden paper slips down the conduits. The paper is often followed by blobs of plaster and later, when wiring is started, the fun begins. This is *not* pure fancy; I have known it happen.

Of course, we often meet the problem of outlet boxes being either proud of the finished wall or set too far back and this is mainly due to the plasterers and not the electricians. The latter situation may lead to the box being partially, or wholly, plastered over. I have known the plasterer to remove all the packing in the box so that he could make a neat finish around the edges of the boxes, and in doing so dropped lumps of wet plaster into the conduits *then* replaced the packing. When the conduit was found to be blocked it was a "complete mystery" as to how it happened.

What is the real answer to this problem? I feel that it is up to the site man really, for it would be difficult to produce some sort of block which would fit into a switch-box, for instance, in such a way that the conduits would be shielded yet the edges of the box left so that the plasterer could finish his work neatly.

I make no excuses for repeating words used in these columns before: "The site operative has indeed many problems to contend with."

E.I.B.A. Ball, 1960

SOME 1,000 members of the electrical industry, their ladies and their guests were present at Grosvenor House, London, on Friday for the annual ball of the Electrical Industries' Benevolent Association. They were received by the president, Mr R. R. B. Brown, and Mrs Brown, and after dinner entertained by dancing and by a cabaret. Mrs Brown carried out a lottery draw in which forty attractive prizes presented by firms in the electrical industry were won. During the evening a telegram from HM The Queen, Patron of the EIBA, was read. The funds of the EIBA benefited by some £2,000 as a result of the evening's activities.

The president, Mr R. R. B. Brown, and his lady

Those present included :

1, Electrical Engineers' Exhibition group: Mr R. F. Mathieson between two treasurers; left to right—2, Mr W. F. Parker, Mr A. Crinson and their ladies; 3, Mr and Mrs W. A. Ankerson, Mr and Mrs R. Farrell; 4, Dr and Mrs Castle, Mr and Mrs Mortimer Hawkins; 5, Mr and Mrs I. H. Leitch, Mr and Mrs H. R. Whyte; [6, Mr and Mrs G. Hancock, Mr and Mrs C. Kubale; 7, Mr and Mrs K. S. Estlin, Mr and Mrs J. C. Kubale, Mr and Mrs J. Losemore; 8, Mr and Mrs W. E. Gibbs; 9, Mr and Mrs E. B. Sawyer, Mr and Mrs J. Christie; 10, Mr and Mrs A. H. Young, Mr E. E. Jacobi; 11, Mr and Mrs S. B. Warder, Mr and Mrs Lewis Smith; 12, Mr J. H. Pendry, Mrs White, Mr R. V. Bank; 13, Mr and Mrs A. L. Francis, Mr and Mrs F. Thompson; 14, Dr and Mrs G. Armstrong; 15, Mr and Mrs H. G. W. Hill, Col and Mrs W. E. Dennis

OVERSEAS NEWS

from our correspondents abroad

CANADA

Columbia Plan Agreement

The agreement between the Canadian and United States Governments on development of the Columbia River was reported in ELECTRICAL TIMES for 3 Nov. Since then, further information on the Columbia River hydro-electric scheme has become available. Canada is to construct three major storage dams at a total cost of $450 million including transmission investments. Provided water licences can be obtained by 1961—and some experts doubt if this is likely to be possible—construction work could begin at once and the Canadian storage dams could be completed by 1970, yielding a firm capacity of 1,250,000 kWh as Canada's share of the downstream benefits. The sites for the dams are at Arrow Lakes, Mica Creek and Duncan Lake. The dam at Mica Creek would be the largest, impounding an area of about 8 million acre ft. Development of the American power sites is less specific, but Canada will receive back from the US half of all additional power produced at the relatively low cost of less than 0·4 cents per kWh. Canada will also receive an estimated $65 million in cash from the US over a 60 year period in return for flood protection provided by the storage dams. Canada retains the right to divert water from the Kootenay River in eastern British Columbia to the upper reaches of the Columbia after 20 years. In return, the US will be granted an option for five years to proceed with construction of a trans-boundary reservoir on the Kootenay by constructing a dam at Libby. If this dam was constructed, Canada would receive substantial benefits in increased power protection and flood control. Mr Diefenbaker said that the Federal Government has offered to finance half the cost of the three storage dams with the province of British Columbia carrying the balance. However, there are suggestions from BC that the State may choose to raise the entire fund on its own.

Village for Nuclear Project Sited

Preliminary site work will begin shortly on the Atomic Energy of Canada Ltd., nuclear research establishment to be built at Whiteshell, between the north shore of Sylvia Lake and the Pinawa Channel, about 50 miles north east of Winnipeg. About two miles from the nuclear site, a village is to be constructed for the estimated 500 workers at the establishment. The Whiteshell establishment will concentrate on power reactor development and the first facility to be built there will probably be an organic liquid-cooled reactor, with heavy water moderator.

Shawinigan Earnings Up

Consolidated net earnings of the Shawinigan Water and Power Co. for the first nine months of this year were $10,431,449, 10½% more than in the same period of 1959. Revenue from sales also rose by 8% to $60,635,207, but were counteracted by a slightly higher rise of 9% in operating expenses to $47,765,679 due mainly to higher cost of additional power purchases.

New Hydro Plant For Alberta

Two new hydro-electric generators have recently been brought into service to supplement the Spray Project, completed nine years ago. A 40,000 h.p. hydro generator has been added at Rundle, and a second 62,000 h.p. unit at Spray plant. In the past three years, demand has grown annually at over 13%. When completed the extensions will bring Calgary Power hydro capacity to a total of 411,450 h.p.

QATAR

Cables for New Power Station

A £300,000 cable contract for the new Ras Abu Aboud power station in the Sheikhdom of Qatar, and for a system of overhead and underground transmission lines and cables, has been awarded to the BICC group by the Government of Qatar. Installation work is being carried out in two stages by the British Insulated Callender's Construction Co. The first stage consists of laying two 66 kV oil-filled power cables, with pilot cables, to interconnect the new power station with an existing station at Doha, four miles away. A 66 kV transmission line is also being constructed to link with Umm Said and Wakrah, 24 miles distant.

In the second stage, scheduled for 1962, 11 kV power cables will be laid, and control cables to enable the new station and the existing stations at Doha to operate in parallel.

The new station will make power available for a large sea water distillation plant.

GHANA

Rural Electrification

Forty-five towns and villages in rural areas of Ghana will benefit from an electrification scheme recently initiated by the Minister of Works and Housing. A British firm has been invited to carry out an electrification survey immediately. The Minister said that the project would eventually be incorporated into a national electricity network when abundant supplies of power would be available from hydro sources.

INDIA

Steam Plant Contracts

An order for a coal-fired unit boiler for the extension of Hussainsagar power station, Hyderabad, has been placed with Clarke, Chapman and Co. Ltd. This company has also received a second order for a specially designed boiler unit capable of being fired by coal, oil, coal and bamboo sawdust or oil and bamboo sawdust. The boiler is to be installed at the Gwalior rayon silk factory.

Bhakra No. 1 on Load

The first of five 100 MVA hydro-electric generators was recently put on load at the Bhakra power station which is now nearly completed. Part of the £130 million Bhakra-Nangal project, the Bhakra dam which is 740 ft high and 1,700 ft long will eventually supply water to two power stations with a total installed capacity of more than 1,000 MW. The five generators for the first station are being supplied by AEI.

Gift Power Station

The enviable problem of where to site a gift power station now faces Indian engineers. A 250 MW power station, a gift following the last visit of Mr Khrushchev, is to be sited near the Rihand Dam. The problem is whether to site the station on the Singrauli coal fields at Kota, or near to the Rihand hydro power house. Location at Kota will require an expenditure of Rs1·5 crores for a transmission line, but on the other hand, siting near the Rihand power house would require transport of coal across a 30-mile wide lake. Transport by ships or by a ropeway across the lake is estimated to cost Rs30 lakhs or Rs60 lakhs.

A project which has also been approved in principle by the Central and Water Power Commission is utilisation

of the Rihand tail water at Obra, 20 miles downstream of the present dam. Here again, there are alternatives, either to construct a 60 MW hydro station at Chopan at a cost of Rs14 crores or a 40 MW station at Obra, costing Rs11 crores.

Punjab Plans Pruned

A cut of more than Rs65 crores has been imposed by the Planning Commission on the draft third Five-Year Plan prepared by the Punjab Government. The Government have decided, however, that power generation proposals will be fully implemented, for even though they are not cut, the State will face a shortage of plant in 1965-66 of 256 MW. The main provisions in the third Five-Year Plan are for an expenditure of Rs20 crores on the Beas project; the right bank power station at Bhakra with transmission line Rs18,74,00,000; thermal generation Rs5 crores; diesel generation by industrial consumers Rs2 crores; a power house on the upper Bari Doab canal Rs4·5 crores, and the second stage of the Uhl River power project Rs2,72,00,000. Where the cuts will be made in the draft plan is now being worked out and the State Government is also expected to decide soon how much it can spend in the first year of the third Plan. A total of Rs231 crores allotted to the Punjab includes the Central Government contribution of Rs134 crores. The balance will have to be found by the State from its own resources. In the second Plan period the State could find only Rs67 crores and, therefore, additional resources capable of yielding another Rs36 crores will have to be found for the third Plan period.

AUSTRALIA

Herbert River Survey

The Co-ordinator General of Road Surveys said in his annual report that preliminary field work continued over the past year on the hydro-electric potential of the Upper Herbert River area. Work completed or in hand includes investigation of possible storage and dam sites on Herbert River and Blencoe Creek and conduit and penstock routes leading into the Herbert River Gorge.

Power Project for Whitsunday Islands

A preliminary report outlining proposals to extend power supply to the South Molle, Hayman and Long Islands of the Whitsunday group was recently prepared by the manager of the Mackay Regional Electricity Board.

Estimated cost of the project is put at £140.500. It would include submarine cables linking the mainland with South Molle, and South Molle with Hayman Island. Another cable would link South Molle to Long Island. Substations and overhead reticulation would be required on all three islands. Total loading of the scheme allowing for future developments is estimated at 1·5 MVA

Steady Progress by S.E.A.

An increase in electricity sales by more than 9% to a new record of 694,409,428 kWh was achieved by the Southern Electricity Authority of Queensland during the last year. Sales yielded £8 million and revenue exceeded expenditure by £342,274. Number of consumers rose during the year by nearly 8,000 mainly as a result of growth in provincial areas. Transmission has been extended further west and the Authority is now supplying bulk power to Dalby. It is also recently reported that the State Cabinet has ordered that the 10% electricity surcharge in the Southern Electric Authority area to be reduced to 5% from 1 Oct. and has initiated negotiations which are expected to result in early removal of the remaining surcharge.

New Station at Callide?

Anticipating the results of a special report on future electrical development in Queensland, Rockhampton Council resolved that they would support erection of a power station at Callide or any other place in Central Queensland that might be recommended. The report is being prepared by an English firm of consultants and although it has not yet been tabled in Parliament, rumour has it that it is in circulation.

NEW ZEALAND

Christchurch Results

An increase of 10·5% in units sold by the Christchurch Municipal Electrical Department during the year ended 31 March last was higher than anticipated. There is to be an adjustment of tariffs in the current year in order that approximately half of the annual capital expenditure shall be obtained from revenue. The year's operations resulted in a trading surplus of £10,983—5·85% of turnover—and was noteworthy in that the load factor rose to over 50% for the first time in a normal year's operations. Mr G. H. Battersby, the general manager, points out that the load factor has been built up to that figure by the use of the ripple system for controlling the water heating load, and has been achieved without any water heaters being disconnected for more than two hours at a time. An additional 2,331 electric cookers and 2,546 water heaters were connected during the period covered by the report.

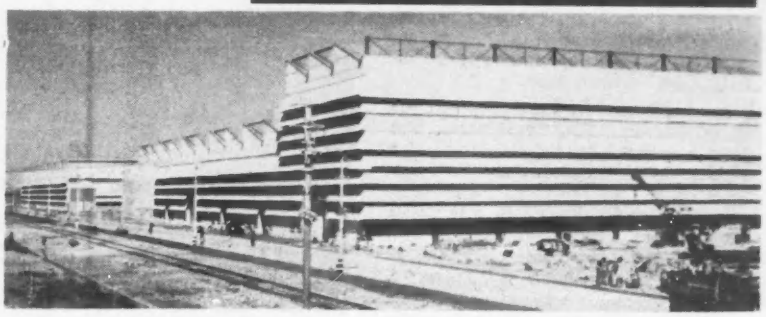
Water Turbine Order

Three 42,000 h.p. vertical Francis turbines have been ordered by the New Zealand Electricity Department from Boving and Co. (ANZ) Pty. The turbines will be installed at the Aratiatia power station on the Waikato River in the North Island. The turbines will be designed to operate under a head of 110 ft at a speed of 136 r.p.m. and will be delivered in 1962-63.

Geothermal Pipework

Contracts worth more than £900,000 have been awarded to Aiton and Co. for the supply and erection of pipework and ancillary equipment for the new geothermal natural steam project at Wairakei, on the North Island of New Zealand. The supply contract, worth £578,660, was obtained from the New Zealand Government, and that for the erection, valued at £323,323, from Waite-Tileman who are also contractors.

The Prime Minister of India, Mr Nehru, with Lal Bahadur Shastri, Indian Minister of Commerce, at the opening of Heavy Electricals, Bhopal. The managing director of AEI Overseas, Mr F. J. E. Tearle, and the director of engineering, Mr W. L. Beeby, are on the right



Exterior of part of the Bhopal factory, opened by Mr Nehru on 6 November

Personalities *in the industry*

Two new district managers have been appointed by the London Electricity Board—**Mr J. P. Tanner,** A.M.I.E.E., for the North Western district, and **Mr R. D. Goodson** for the South Eastern district (*ESH, pages 77 and 81). Mr Tanner, who has been engineer to the Board's Northern district since 1957, was sub-area design and planning engineer for the previous nine years. Prior to nationalisation of the industry he was borough electrical engineer at Stoke Newington for a year, after serving with the St. Pancras undertaking from 1939. There he successively held the positions of assistant meter superintendent, deputy consumers' engineer and, ultimately, consumers' engineer. He obtained early training with Mumford and Sons, later joining the Plymouth Corporation undertaking and, subsequently, gained experience at Finchley and Stafford. Mr Goodson has also held his present post —district commercial engineer for the Board's South Eastern district—since 1957. He started with the Croydon Corporation undertaking following training at the Croydon and Regent St Polytechnics. Later he served at Brighton and with the County of London Electric Supply Co., until war service interrupted his career. Afterwards he was assistant district consumers' engineer with that concern and, from 1948 to 1950, was district commercial officer with the LEB at E. Wandsworth. He then became district commercial officer at Wimbledon and from 1951 to 1957 was a branch head in the Commercial Dept. at the Southern sub-area.

Mr K. Hartshorn has joined the General Electric Co. Ltd. as advertising and marketing manager of its Radio Group.

Troughton and Young (Lighting) Ltd. announce that **Mr A. B. Read,** R.D.I., has rejoined them as design consultant. Mr Read will also continue his association with Carter and Co. Ltd. in a consulting capacity.

At present managing director of William Doxford and Sons (Engineers) Ltd., **Mr Robert Atkinson,** D.S.C., R.D., B.SC., M.I.MECH.E., M.I.MAR.E., has been appointed managing director of the Engineering Division of Tube Investments Ltd. with effect from 1 March, 1961.

London Transport announces that **Mr H. W. Hadaway,** A.M.I.E.E., M.I.R.S.E., has been appointed a principal executive assistant in the Signal Engineer's Department with the title of installation engineer (signals). He will be responsible for installing, testing and passing out all new installations and major renewals of all types of signalling equipment. A member of the Council of the Institution of Railway Signal Engineers, he was awarded the Institution's first prize in 1950 for his paper on "Improvements in Track Circuit Shunts." He originally joined the London Electric Railways in 1927 as a signalling apprentice and, shortly after completion of his apprenticeship, was appointed a technical assistant. He became an executive assistant in 1946 and a senior executive assistant three years later.

Mr A. B. Skevington, acting manager of Philips' Nottingham branch since September, 1959, is now appointed branch manager there. He joined the Nottingham branch in 1949 as a lighting representative and was promoted a sales supervisor in May, 1955. Two years later he was made area manager of the Electrical Appliances Group.

The Hon Sir Arthur Howard, K.B.E., C.V.O., D.L., J.P., has been reappointed a part-time member of the South Eastern Electricity Board.

Aerialite Ltd. have appointed **Mr Ian McKay** as their technical representative for their Floor-warming Department in Scotland.

Mr D. Shelton has been appointed manager of the Newcastle upon Tyne branch of Dictaphone Co. Ltd. He was previously at their Manchester branch office and succeeds **Mr B. Legat.**

Mr H. C. Margrett, general manager and a director of GEC Overseas Services Ltd.—a subsidiary of the General Electric Co. Ltd.—has retired after 40 years' service with GEC. Educated at King Edward's School, Birmingham, where he was a Foundation Scholar, Mr Margrett went to the University of Birmingham where he graduated as a Bachelor of Commerce. He joined GEC as a commercial trainee and, subsequently, became commercial assistant in the newly formed Osram Valve Department. In 1934 he was appointed assistant manager of the Southampton branch and in 1936 became manager of the Hong Kong branch of the General Electric Co. of China Ltd. From 1942 to the end of the war, Mr Margrett was imprisoned by the Japanese in the Stanley Internment Camp, Hong Kong. After rehabilitation leave, he returned to Hong Kong. In 1950 he was appointed assistant managing director of the British General Electric Co. Ltd. Hong Kong and, in 1951, became managing director. While in Hong Kong, Mr Margrett became a Justice of the Peace. Returning to this country in 1953 he became manager of the GEC Business Development Department at head office and, in 1959, was appointed general manager and a director of GEC Overseas Services Ltd.

The BBC announces the appointment of **Mr J. D. MacEwan,** B.SC., A.M.I.E.E., A.M.BRIT.I.R.E., as engineer-in-charge, television, Birmingham, in succession to **Mr H. G. Whiting,** A.M.I.E.E., who recently became regional engineer, Midland region. Mr MacEwan joined the Operations and Maintenance Department of the BBC in 1947 and after service in Glasgow and Edinburgh he became a member in 1953 of the staff of the BBC's Television Outside Broadcast unit covering Scotland and north-east England. During the following year he was transferred to the television staff in Glasgow. In 1956, Mr MacEwan was appointed senior lecturer (technical operations) at the Corporation's Engineering Training Department, Wood Norton, Worcestershire, which post he has held until taking up his new duties in Birmingham on 14 Nov.

Mr J. F. Taylor has been appointed as a representative of the M-O Valve Co. Ltd.—a subsidiary of the General Electric Co. Ltd.—for the GEC range of domestic valves and TV tubes.

Mr L. C. Jesty, B.SC., M.I.E.E., has been appointed manager of Sylvania-Thorn Colour Television Laboratories Ltd., in succession to **Mr B. C. Fleming-Williams,** B.SC., A.M.I.E.E., who has left the company and is now on a visit to the USA, we understand. Mr Jesty joined the laboratories in 1957 and has been mainly responsible for the research and development programme on colour television and cathode-ray tubes. **Mr J. K. Oxen-**

Mr J. P. Tanner

Mr R. D. Goodson

Mr H. C. Margrett

** Denotes revision to the "Electricity Supply Handbook, 1960."*

ham, M.A., who has been in charge of circuit work on colour and closed circuit television, has been appointed deputy manager.

With the centralising of activities of Ekco Electronics Ltd. certain individual responsibilities have been reorganised. **Mr P. L. Stride,** formerly manager of the Malmesbury Wks, becomes manager of the Aviation Division, and **Mr P. J. Harvey,** previously chief electronics engineer, becomes manager of the Nucleonics and Industrial Division. **Mr E. B. Thompson** continues handling the commercial activities of both divisions as sales manager.

Mr P. L. Edwards has retired from the managership of the Dublin office of Associated Electrical Industries Export Ltd., although he will continue for a time as consultant. He is succeeded as manager by **Mr J. W. Jackson,** previously deputy manager of the Dublin office. Mr Jackson served his apprenticeship with Mather and Platt Ltd. and joined Metropolitan-Vickers' Motor Sales Dept. in 1929. After a period with the Sheffield district office he was at the Glasgow office from 1936 to 1955, when he became manager of the company's Dublin sub-office. On the integration of the M-V and BTH companies' offices in October, 1959, he was appointed deputy manager of AEI Export Ltd., Dublin branch office. Mr Edwards, a past-president of the Society of Irish Electrical Traders, had been manager of the Dublin office since 1932, having started with BTH in 1923 after periods with GEC and Harland and Wolff Ltd.

Prof F. C. Williams, O.B.E., D.SC., D.PHIL., F.R.S., was last Thursday presented with the John Scott medal and scroll. The presentation was made by Dr T. H. Osgood, scientific attaché to the American Embassy on behalf of the City Trust of Philadelphia. The award was made in recognition of Professor Williams' work on the "Identification Friend or Foe" system developed in the second world war.

For many years manager of the GEC Motion Picture and Television Section, **Mr R. B. Hartley,** F.B.K.S., A.R.P.S., F.R.S.A., has now joined Superlamp Ltd. He will continue to concentrate on the film and television studios industry.

Several new appointments in the Sales Division of Servis Domestic Appliances are announced. **Mr L. H. Brueton** becomes sales promotion manager (UK); **Mr H. Lucas** is assistant home sales manager; and **Mr A. A. Conway** London sales manager. Two divisional sales managers are: **Mr W. Lucas,** for Bristol and the West, and **Mr R. V. George,** for London, N.W. In addition, **Mr G. C. Leary** is public relations officer.

Mr G. A. Marriott, managing director of the M-O Valve Co. Ltd., a wholly owned subsidiary of the General Electric Co. Ltd., has intimated his intention to retire in March next year. He will be succeeded as managing director of the company by **Mr J. Bell,** B.SC., F.INST.P., who is at present deputy director and manager of GEC Research Laboratories and a member of the M-O V board.

Mr L. C. Jesty

Mr J. W. Jackson

Mr G. A. Marriott

Prof A. C. B. Lovell, O.B.E., F.R.S., professor of radio astronomy in the University of Manchester and director of the Nuffield radio astronomy laboratories, Jodrell Bank, has been awarded a Royal Medal by the Royal Society for his distinguished contributions to radio astronomy.

Mr E. V. Beatson, of Joseph Lucas Ltd., has been appointed by the Council of the British Welding Research Association to serve on the Association's Research Board. His principal fields of interest are resistance welding and brazing.

Previously a director of the Key Engineering Co. Ltd., **Mr F. V. Whickham,** A.M.I.C.E., M.R.S.H., has joined the board of Temple Tubes Ltd., manufacturers of pitch fibre pipes and conduit. The latter concern is a subsidiary of Limehouse Paperboard Mills Ltd. Mr Whickham will be concerned particularly with co-ordination of product development and sales.

Formerly group commercial director of the Solartron Electronics Group, **Mr E. E. Jones** has relinquished that position to become managing director of Adrema (Holdings) Ltd.

Mr G. Hofman, managing director of Philips Electrical Ltd., recently completed 40 years' service with the Philips' organisation.

Mr H. G. Houghton has been appointed chairman of the Engineering and Lighting Equipment Co. Ltd. following the death last month of the Earl of Verulam. Mr Houghton thus becomes chairman and managing director, with **Mr F. Webster** as deputy managing director, and the other members of the board are: **Mr C. S. K. Benham, Mr C. G. Maynard,** and **Mr. R. Proctor,** who is also company secretary.

Mr P. Jardine, group financial controller of Metal Industries Ltd. has been appointed to the boards of two of the subsidiaries in that group, J. G. Statter and Co. Ltd. and Minerva Mouldings Ltd.

AEI Lamp and Lighting Co. Ltd. have appointed **Mr A. B. Frost** the assistant manager of their Midland sales region. Mr Frost was previously assistant to the regional manager and from 1955-1958 the Northampton area manager.

Mr C. R. Hughes, mechanical engineer in the No. 3 (South East Durham) area of the Durham Divisional Coal Board, has been appointed chief engineer in the area. From 1946 to 1949, when he returned to Durham, he was electrical engineer with the Shipley and Ilkeston Collieries Ltd., Derbyshire.

To mark his retirement after 40 years' service in the industry, **Mr W. B. Gold,** area workshops engineer for Monmouthshire and Mid-Wales, South Wales Electricity Board, was presented with a colour slide projector and screen by **Mr D. G. Gwyn,** the Board's area manager, recently.

OBITUARY

Dr G. W. O. Howe, Emeritus Professor of Electrical Engineering at Glasgow University, died on 7 Nov., aged 84. He held the James Watt Chair of Electrical Engineering for 25 years until retiring in 1946. He was in charge of the electrical engineering department at Hull Municipal Technical College before being appointed a lecturer at the City and Guilds Engineering College in 1905. Four years later he became assistant professor of engineering. When he was appointed to the James Watt Chair at Glasgow in 1921, he was head of the department of electrical standards and measurements at the National Physical Laboratory, Teddington. Prof Howe was president of the engineering section at the meeting of the British Association at Toronto in 1924 when he surveyed 100 years of electrical engineering down to the beginnings of radio telegraphy and telephony. In 1956 he was awarded the Faraday Medal of the IEE for his pioneering work in the study and analysis of h.f. oscillations and on the theory of radio propagation, and for his outstanding contributions to engineering education. Dr Howe was editor of the *Wireless Engineer* from 1926 to 1954.

Mr R. Lawler, manager of the Electronics Division of Ferguson Radio Corporation Ltd., died on 2 Nov., aged 59.

Mr J. R. Hall, A.M.I.E.E., formerly deputy borough electrical engineer at Accrington, died recently, aged 74. He retired in 1950 after serving in the Corporation Electricity Dept. for 46 years.

NEW LITERATURE

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Redgrave's Factories, Truck and Shops Acts: Supplement to 19th Edition, by John Thompson and H. R. Rogers, noting new Court decisions and regulations. Published by Butterworth and Co., 152 pages, 6¾ in. by 4¼ in. Price 15s.

Boiler House Practice, by J. N. Williams. Covers City and Guild exam. syllabus in boiler house practice. Published by George Allen and Unwin. 648 pages, 9¼ in. by 6 in. Third edition. Price 70s.

The Use of Welding in Steel Building Structures, by G. B. Godfrey. Guidance on design of metal arc welded steel buildings in conformity with BS 449:1959, under nominal static loading conditions. Published by British Constructional Steelwork Association, 35 pages, 11 in. by 8¼ in. Price 3s 6d.

Translation from Russian for Scientists, by C. R. Buxton and H. S. Jackson. Designed to enable scientists to acquire adequate reading knowledge of Russian language. Published by Blackie and Son Ltd., 299 pages, 8½ in. by 5¼ in. Price 30s.

Proceedings of the International Clean Air Conference. Record of 78 papers on clean air topics presented to London conference in October, 1959, together with discussions on them. Published by the National Society for Clean Air, 290 pages, 9¼ in. by 6¼ in. Price 30s.

Principles and Practice of Aircraft Electrical Engineering, by H. Zeffert. Comprehensive review with emphasis on design problems. Published by George Newnes Ltd., 726 pages, 8½ in. by 5¼ in. Price 90s.

Cabma Register of British Industrial Products for Canada. 1960-61. This eighth edition, completely revised, provides in five sections a classified list of products, French glossary, British manufacturers, Canadian distributors, and trade names of the various firms. Published by Iliffe and Sons Ltd., 636 pages, 9¼ in. by 7 in. Price 15s.

Extending an Aluminium Plate and Strip Mill

POWER SUPPLY AND LIGHTING DETAILS

EXPANSION of the Alcan Industries aluminium plant at Rogerstone is being carried out under a £10 million four-year programme concentrating on the existing continuous strip mill, laid down at the Rogerstone works in 1949 and 1950. The new work covers installation of new equipment, modernisation of some existing equipment and relocation of some plant items to improve work flow. Outstanding in the new plant is a 144 in. hot reversing mill, described in the ELECTRICAL TIMES of 13 and 27 Oct., but there is much else of electrical interest in the Rogerstone work.

Fig. 2 shows the flow chart for part of the revised layout. Whereas the original hot rolling layout in 1950 consisted of the 96 in. mill used as a breaking down mill, an 84 in. roughing mill and two 88 in. finishing mills in tandem, the path from ingot to strip now consists of a 144 in. four-high mill which can be used either for breaking down or for rolling wide plate, the 96 in. mill and three 88 in. four-high hot-finishing mills working as a three-stand mill in tandem. The new hot reversing mill has been built and installed by Davy and United Engineering Co. with electrical drives and control by AEI.

Electricity Supply and Drives

When the continuous strip mill was laid down in 1949-50, the supply system was reorganised to allow a 66 kV supply to be brought into a new substation on the works site. The feeders were connected via outdoor duplicate busbars to two 20 MVA and one 15 MVA 66/11 kV transformers, feeding on their secondary sides a duplicate busbar 250 MVA switchboard. This switchboard supplied existing ring mains and new substations by radial feeders.

Involved in the replanning is movement and regrouping of existing substations, rather than creation of extra stations. In some areas, temporary substations have been established to give flexibility for future expansion schemes of which only the broad outline is known at present.

Referring to Fig. 2 for some indication of location, the swarf remelt department is one of the plants which has had to be moved to a new site. It is concerned with remelting swarf and light scrap and for this purpose uses two mains-frequency induction furnaces, each rated at about 500 kW. An aluminium bath holding the scrap acts as a secondary for the induced current.

A 400 V supply is taken to the furnaces from Scott-connected transformers in an existing substation, which was amongst those moved to a new site. Correction of power factor is obtained by a bank of capacitors connected to a system of aluminium busbars. (Extensive use of aluminium conductors in one form or another is, not surprisingly, a feature of the installation at Rogerstone.) The substation is to be used in the future for supplying new pumping equipment through English Electric switchboards with built-in Donovan starters.

Supply to the 144 in. hot mill is taken through substation equipment which already existed, but which was resited in the mill motor room basement. The mill has an installed load of about 12,000 h.p. To supply the main 11 kV switchboard, existing 0·4 sq in. feeders were extended, and a third feeder was run in aluminium-sheathed paper-insulated cable.

Large m.g. sets associated with the mill are supplied at 11 kV, with 400 V circuits in the mill area fed through a 100 ft long open panel incorporating a bus-section switch and two incoming feeder switches, each of 1,200 amp capacity. The feeders are supplied through two 750 kVA Crompton transformers. From the substation are run two 11 kV cables supplying subsidiary substations, one for auxiliaries associated with the four oil-fired pre-heating furnaces, the other powering the pump house dealing with roll coolant for the mill.

Each of the subsidiary substations has a 750 kVA Crompton transformer, through which are supplied various local switchboards (English Electric). Amongst the equipment supplied is 100 kW immersion heaters. Five heaters warm the

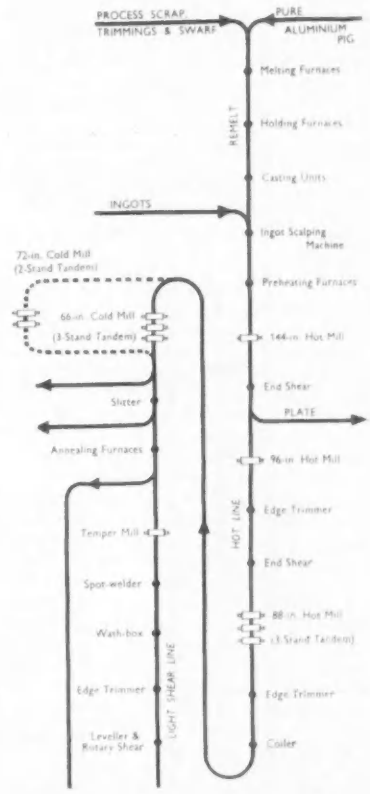

Fig. 2. Layout for plate and strip line. Output may be in the form of container sheet, general sheet products, circles or building sheet, as well as plate. The dotted section will come into operation next year

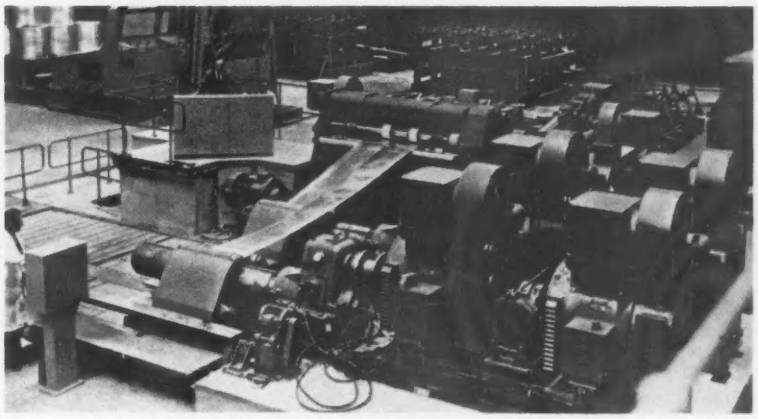

Fig. 1. 72 in. slitting line in the cold mill, showing slitting in process

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A First Course in Television, by "Decibel." Working principles explained for readers with some knowledge of radio. Published by Sir Isaac Pitman, 149 pages, 7¾ in. by 4½ in. Price 15s.

Redgrave's Factories, Truck and Shops Acts: Supplement to 19th Edition, by John Thompson and H. R. Rogers, noting new Court decisions and regulations. Published by Butterworth and Co., 152 pages, 6¾ in. by 4¼ in. Price 15s.

Boiler House Practice, by J. N. Williams. Covers City and Guild exam. syllabus in boiler house practice. Published by George Allen and Unwin. 648 pages, 9¼ in. by 6 in. Third edition. Price 70s.

The Use of Welding in Steel Building Structures, by G. B. Godfrey. Guidance on design of metal arc welded steel buildings in conformity with BS 449:1959, under nominal static loading conditions. Published by British Constructional Steelwork Association, 35 pages, 11 in. by 8½ in. Price 3s 6d.

Translation from Russian for Scientists, by C. R. Buxton and H. S. Jackson. Designed to enable scientists to acquire adequate reading knowledge of Russian language. Published by Blackie and Son Ltd., 299 pages, 8½ in. by 5¼ in. Price 30s.

Proceedings of the International Clean Air Conference. Record of 78 papers on clean air topics presented to London conference in October, 1959, together with discussions on them. Published by the National Society for Clean Air, 290 pages, 9¼ in. by 6¼ in. Price 30s.

Principles and Practice of Aircraft Electrical Engineering, by H. Zeffert. Comprehensive review with emphasis on design problems. Published by George Newnes Ltd., 726 pages, 8½ in. by 5¼ in. Price 90s.

Cabma Register of British Industrial Products for Canada. 1960-61. This eighth edition, completely revised, provides in five sections a classified list of products, French glossary, British manufacturers, Canadian distributors, and trade names of the various firms. Published by Iliffe and Sons Ltd., 636 pages, 9¼ in. by 7 in. Price 15s.

Extending an Aluminium Plate and Strip Mill

POWER SUPPLY AND LIGHTING DETAILS

EXPANSION of the Alcan Industries aluminium plant at Rogerstone is being carried out under a £10 million four-year programme concentrating on the existing continuous strip mill, laid down at the Rogerstone works in 1949 and 1950. The new work covers installation of new equipment, modernisation of some existing equipment and relocation of some plant items to improve work flow. Outstanding in the new plant is a 144 in. hot reversing mill, described in the ELECTRICAL TIMES of 13 and 27 Oct., but there is much else of electrical interest in the Rogerstone work.

Fig. 2 shows the flow chart for part of the revised layout. Whereas the original hot rolling layout in 1950 consisted of the 96 in. mill used as a breaking down mill, an 84 in. roughing mill and two 88 in. finishing mills in tandem, the path from ingot to strip now consists of a 144 in. four-high mill which can be used either for breaking down or for rolling wide plate, the 96 in. mill and three 88 in. four-high hot-finishing mills working as a three-stand mill in tandem. The new hot reversing mill has been built and installed by Davy and United Engineering Co. with electrical drives and control by AEI.

Electricity Supply and Drives

When the continuous strip mill was laid down in 1949-50, the supply system was reorganised to allow a 66 kV supply to be brought into a new substation on the works site. The feeders were connected via outdoor duplicate busbars to two 20 MVA and one 15 MVA 66/11 kV transformers, feeding on their secondary sides a duplicate busbar 250 MVA switchboard. This switchboard supplied existing ring mains and new substations by radial feeders.

Involved in the replanning is movement and regrouping of existing substations, rather than creation of extra stations. In some areas, temporary substations have been established to give flexibility for future expansion schemes of which only the broad outline is known at present.

Referring to Fig. 2 for some indication of location, the swarf remelt department is one of the plants which has had to be moved to a new site. It is concerned with remelting swarf and light scrap and for this purpose uses two mains-frequency induction furnaces, each rated at about 500 kW. An aluminium bath holding the scrap acts as a secondary for the induced current.

A 400 V supply is taken to the furnaces from Scott-connected transformers in an existing substation, which was amongst those moved to a new site. Correction of power factor is obtained by a bank of capacitors connected to a system of aluminium busbars. (Extensive use of aluminium conductors in one form or another is, not surprisingly, a feature of the installation at Rogerstone.) The substation is to be used in the future for supplying new pumping equipment through English Electric switchboards with built-in Donovan starters.

Supply to the 144 in. hot mill is taken through substation equipment which already existed, but which was resited in the mill motor room basement. The mill has an installed load of about 12,000 h.p. To supply the main 11 kV switchboard, existing 0·4 sq in. feeders were extended, and a third feeder was run in aluminium-sheathed paper-insulated cable.

Large m.g. sets associated with the mill are supplied at 11 kV, with 400 V circuits in the mill area fed through a 100 ft long open panel incorporating a bus-section switch and two incoming feeder switches, each of 1,200 amp capacity. The feeders are supplied through two 750 kVA Crompton transformers. From the substation are run two 11 kV cables supplying subsidiary substations, one for auxiliaries associated with the four oil-fired pre-heating furnaces, the other powering the pump house dealing with roll coolant for the mill.

Each of the subsidiary substations has a 750 kVA Crompton transformer, through which are supplied various local switchboards (English Electric). Amongst the equipment supplied is 100 kW immersion heaters. Five heaters warm the

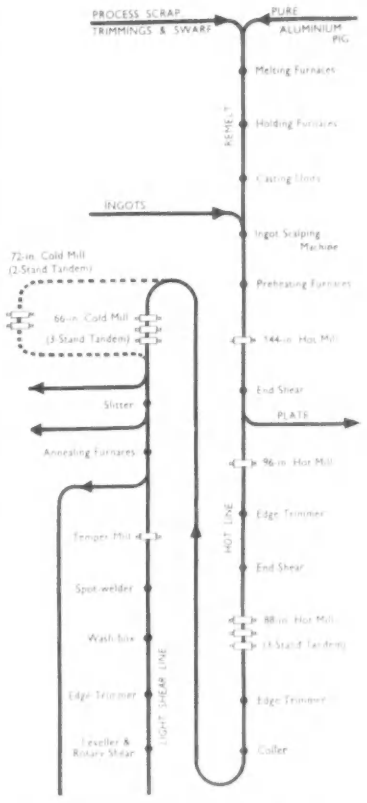

Fig. 2. Layout for plate and strip line. Output may be in the form of container sheet, general sheet products, circles or building sheet, as well as plate. The dotted section will come into operation next year

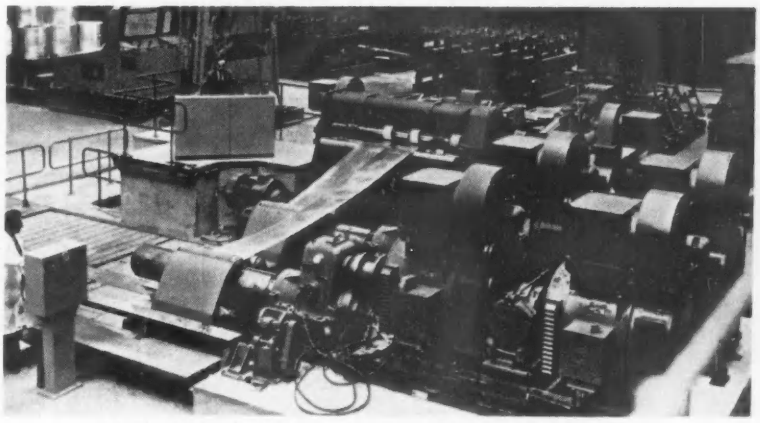

Fig. 1. 72 in. slitting line in the cold mill, showing slitting in process

soluble oil used in the roll coolant system to a working temperature of up to 150°F. The coolant loses heat to a 1,500 g.p.m. cooling tower system (Davenport Engineering). Auxiliary equipment on the pre-heating furnaces is controlled by Donovan contactor panels.

An additional stand has been provided on the 88 in. hot-finishing mill installation. All three stands are now powered by a rectifier installation. Mill motors are rated two at 4,000 h.p., one at 2,600 h.p., and are described later in this article. An AEI 11 kV switchboard supplies, in addition to the mill motors, a 1,000 h.p. synchronous motor-generator set. This provides power for down-coilers located immediately after the mill and gives the necessary power factor correction at the substation. 400 V auxiliaries are again supplied through a 750 kVA Crompton transformer.

Furnaces

Expansion to the cold-finishing facilities involved installation of two oil-fired annealing furnaces, a high-speed slitting machine and handling equipment with capacity to handle coils up to 9,000 lb.

Each of the new furnaces includes eight 55 h.p. fan drives and these, together with other motor loads, are controlled through Brookhirst Igranic contactor panels, with supplies through English Electric switch- and fuse-boards, in turn controlled by air circuit-breakers. Two Crompton 750 kVA transformers give the 400 V supply to these boards, taking their 11 kV supply from an existing substation some distance away. As in all such cases, inter-tripping of h.t. and l.t. switches is provided for and remote trip buttons for the 11 kV breakers are fitted on the 400 V switchboard.

In a future extension of the cold mill an existing 72 in. two-stand tandem cold-finishing mill will be installed with new driving motors to give increased speed and power. The 2,200 h.p. motors involved will be supplied from existing m.g. sets formerly used on the 88 in. mills now changed to rectifier drives. A further two 2,200 h.p. motors may be added later. A new substation is being built for this mill, supplied from the main substation through two new 0·4 sq in. feeder cables. Mill auxiliaries will be controlled through a cubicle-type English Electric switchboard.

Electrical Details

Having established some of the electrical plant changes at particular locations, the general electrical distribution background may be considered. At the main substation, existence of a considerable reserve of transformer capacity limited the extra installation needed to meet the greater electrical load. Changes have, in fact, been confined to addition of an oil-circulation pump and fan cooling to uprate the existing 15 MVA transformer to 21 MVA and so make it fully interchangeable with the other two 20 MVA transformers. The 11 kV switchboard at the main substation has been extended by the addition of three new panels to accommodate additional feeders.

Cables for 11 kV have copper conductors, but are aluminium-sheathed. Although sizes of up to 0·4 sq in. with drawn-down aluminium sheaths have been used, a change was made to corrugated-sheathed types as soon as they became available, because they are considered to have greater flexibility, superior serving and to be cheaper.

In general, plant wiring has been carried out in p.v.c.-insulated, p.v.c.-sheathed single-wire-armoured and p.v.c.-sheathed-overall cable, conductors being stranded aluminium. In control cabling a minimum size of 7/·029 in. has been adopted for reasons of robustness. Since current carrying capacity is not a factor, aluminium conductors of this have been used, with saving in cost.

One of the particularly interesting aspects of the cable installation is the use of Solidal cable, the recently introduced design which incorporates three solid sector-shaped aluminium conductors, p.v.c-insulated, with a concentric neutral formed by a single layer of rectangular aluminium wires (ELECTRICAL TIMES, 4 June, 1959). This has been used for all control and three-phase cabling of above 100 amp rating (Fig. 4).

Solidal cables were selected for this duty as being cheaper than other types, and because their light weight and flexibility was considered greatly to simplify installation. 150, 200 and 300 amp ratings are used. Joints in the cables are made by indent-compression and by soldering using abrasion soldering techniques. Terminals on the concentric neutral were made using standard cone-grip clamps.

MICC cable has been used for furnace wiring. Where large single-core cables have been used as in d.c. work, butyl-rubber insulation has been used with flexible stranded-copper conductors. For transformer secondary connections, paper-insulated aluminium-sheathed and served cable has been used.

Cranes

Some large cranes have been installed in the course of the expansion scheme. They are supplied at 460 V d.c. through grooved-wire downshop leads and collector gear (BICC). Crane controls are either Igranic contactor type or de Renzi pattern controllers supplied by V. G. Howells. Crane motors are mainly by Laurence Scott and Electromotors, except on the ingot handling crane, for which AEI mill-type motors are used. Igranic brakes are generally employed.

The ingot crane is exposed to furnace heat when extracting ingots. It has an air-conditioned cabin and is linked to the mill intercommunication system by a Marconi v.h.f. radio.

Lighting

Lighting fittings in the mill area use 1 kW horizontal mercury lamps by AEI Lamp and Lighting, blended with 1 kW tungsten lamps. They are installed under the roof trusses, 50 ft above floor level. Because of the height, there is not the glare problem that might be expected from such large light sources; it has been found that a mounting height of 30 ft would have been practicable from this aspect. The fittings are switched in three-phase groups, but each has a local isolating switch to make maintenance safer.

In another building where the atmosphere is cleaner, an excellent installation has been obtained using twin 8 ft fluorescent fittings mounted 47 ft high on rows of continuous trunking (Falk, Stadelmann).

For minor lighting installations, 5 ft instant start fluorescent fittings are used. Lighting intensities range from 15 lumens/sq ft in the general mill area up to 25 lumens/sq ft in control rooms.

88 in. Mill

The three stands of the 88 in. mill are powered by separate motors. The

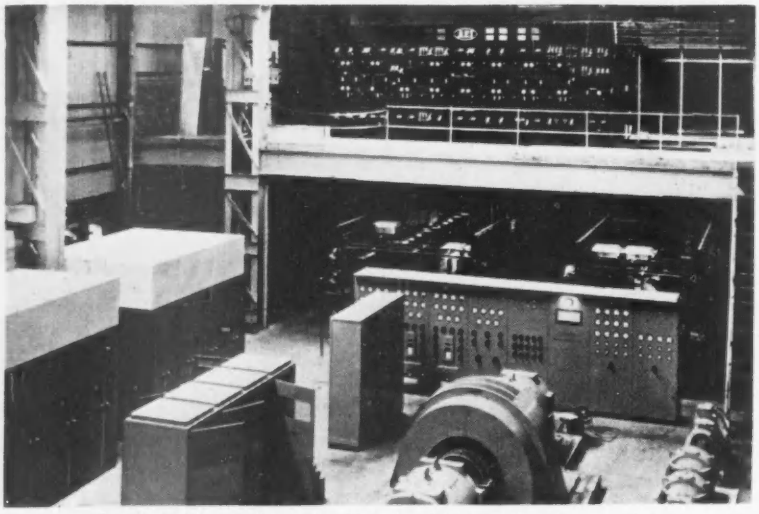

Fig. 3. 11 kV switchboards for 88 in. hot finishing mill and down-coiler

first and second have new motors of 4,000 h.p., 675 V, whilst the outgoing stand retains its 2,600 h.p., 202/404 r.p.m., 440 V motor.

Control is provided by uni-directional closed-loop speed controls, the power being supplied by separate banks of grid-controlled mercury-arc rectifiers for each stand. Speed changes, up to base speed, are effected by variation of the rectifier output and thereafter, up to twice base speed, by field weakening. "Coarse speed" selection is switch-controlled by the mill operattor, who is also provided with a "fine speed" lever-operated potentiometer control for each stand. The control system is sufficiently "stiff" to maintain the actual mill speed to within $\pm\frac{1}{4}\%$ of the selected speed over the range of 60% to 200% of base speed.

Screwdowns are Ward-Leonard-controlled. Duplicate master-control switches are available at the individual control cabinets on the side of the mill stands, as well as in the control cabin.

The choice of rectifiers for the supply of the mill motors was governed by the necessity of providing equipment that could be built into the limited space available, whilst at the same time making provision for a possible future fourth stand. The use of rectifiers was an ideal choice owing to the smaller area required when compared with m.g. sets of equal output. Furthermore, the additional power requirements were in this way obtainable without the further increase in fault capacity inherent in the use of additional m.g. sets driven by synchronous machines.

The alterations involved an almost complete change of control equipment and, since this could not be fitted into the old control cabin, connected, and tested during the normal "shut-down" period, a new control cabin was installed. It was temporarily placed behind the old cabin while the controls were installed and wired to the new control equipment. During the "shut-down" the old cabin was replaced by the already-wired new one.

Hot Coiler

Whilst provision has been made for two hot down-coilers, only one has been installed under the present development. This coiler is driven through a reduction gearbox, having alternative ratios of 7·7/1 and 13·7/1, by either one or two 400 h.p., 375/1,100 r.p.m. motors, depending on whether high tension (9,000 lb to 48,000 lb) or low tension (0 to 9,000 lb) is required. The control is by Ward-Leonard system, both motors being provided with a generator. The selected tension is set by the coiler operator and is automatically maintained by a closed-loop compensated current control, using two-stage magnetic amplifiers. Coil speed is determined by a tachometer fitted on the last stand of the 88 in. mill. The coiler auxiliary controls are housed in a control cabin local to the equipment. This cabin has been designed and positioned to give the operator maximum visibility for all operations.

Ventilation and Heating

For most of the factory area, heat losses from furnaces and machines provides all the heat input that is required for space heating, and concern is more with providing ventilation. However, the area in the 144 in. mill bay around the roll grinding machine requires constant air temperature to ensure a high degree of accuracy in operation. For this reason, it has space heating provided.

In many parts of the factory, static ventilators are suitable, but Brooks fan units are provided over the roll-coolant pump house, and exhauster fans are also used in the cold mill to assist static ventilators in the roof.

The building cladding of the main buildings is of electrical interest in that an interior thermally insulated wall lining is secured to the supporting rails largely by studwelding. This is claimed to be the first large-scale use of this technique in the UK. Crompton Parkinson welding guns were used.

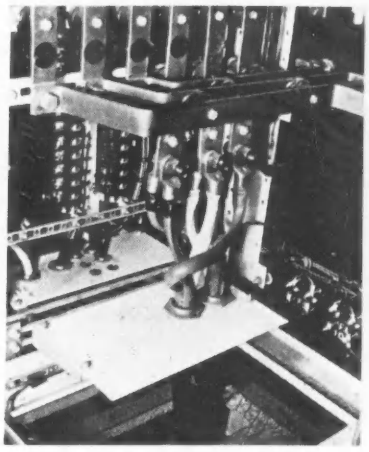

Fig. 4. Some of the Solidal cable extensively used at Rogerstone, terminating at busbars in a switchgear installation

IMPROVED CRANE CONTROL

CLOSE SPEED MATCHING WITH LOAD

A SYSTEM of crane control claimed to give improved hoist performance has been devised by Mawdsley's. The "Mawdomatic" system, as it is known, is being used by Stothert and Pitt on their latest design of tubular dockside crane. The system is particularly suited to this type of application where rapid cargo handling is essential and where a light-hook to full-load speed ratio of up to 4:1 may be required.

An important advantage of the system is that simple, light control gear is used, so eliminating the heavy current switching often needed with d.c. series crane motors and with consequent reduction in contactor maintenance.

The system of control used is based on the conventional Ward-Leonard generator system, but close speed matching to load is obtained by incorporating a special exciter unit on the Ward-Leonard set. This exciter is claimed to control automatically, both the d.c. hoist motor and generator fields to match the load torque required. The exciter is of special design and its output voltage is governed by the Ward-Leonard armature loop current. This system is claimed to give superior performance when compared with the conventional Ward-Leonard system, and to provide the operator with more sensitive control.

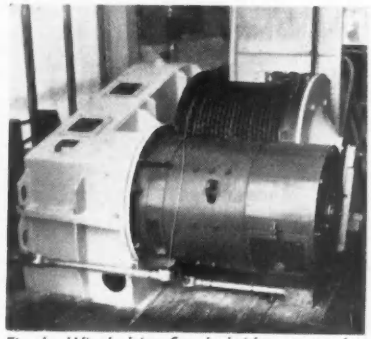

Fig. 1. Winch drive for dockside crane using the "Mawdomatic" control system

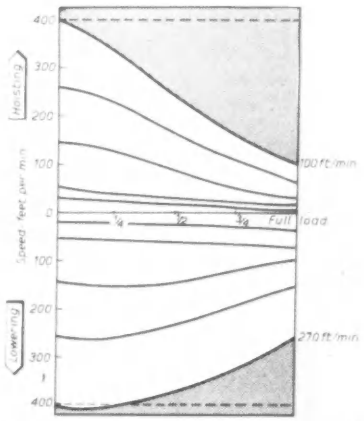

Fig. 2. "Mawdomatic" crane control. Contrasted load characteristics on hoist and lower for a series of no-load speeds

The system also has the advantages of avoiding maximum demand peaks, enabling regeneration to be used and permitting all hoist motors to be controlled by a single-handle joystick.

Even when the lowering speed is 66% of the light-hook speed, a drooping speed/load characteristic can be obtained which is quite stable. The system has so far been applied to crane drives rated up to 105 h.p.

Automatic gauge control for plate mill

PULSE SAMPLING SYSTEM REDUCES OFF-GAUGE OUTPUT

MENTION the words "electronic control" and one automatically gets an impression of something complex, expensive to install and liable to fail at just the moment when the only one who understands it is not at hand. Certainly the bought-out type of equipment is expensive and often over-complicated, largely because it has to be designed to suit a variety of different makes of machine. If, however, one possesses the necessary electrical know-how in the electronic sphere, it is possible to home-produce satisfactory apparatus which will give all the required accuracy for a particular application and machine without recourse to outside help and without necessarily being equally applicable to a similar machine in another place. Moreover, the cost is usually a fraction of the bought-out equivalent.

The Problem

At the Ebbw Vale Works of Richard Thomas and Baldwins Ltd. there arose the problem of eliminating production inaccuracies in the gauge of tinplate rolled on a five-stand mill.

A preliminary study of automatic gauge control systems manufactured by specialist firms soon showed that they were expensive and complex. Moreover, they were based on a scheme of rolling which differed from that in use at Ebbw Vale. Even if authorisation for the expenditure were to be given, there was no guarantee that, in the event of breakdown, the mill would not be back to the unacceptable pre-system levels again. It had, however, already been accepted that the use of contact micrometers was out of date and an order had been placed for an X-ray thickness gauge.

The Instrumentation and Special Engineering Section of the Electrical Engineering Department at Ebbw Vale took up the challenge. They designed a gauge-sampling system using pulses to initiate correction of gauge and tension, the length of pulse being a measure of the degree of correction to be applied.

The Principle

Without entering too much into the technical details of the system, the basic principle can be understood from the schematic diagram in Fig. 1. Tension of the sheet between the adjacent stands is measured by a tensiometer and any variations from the prescribed value are converted into pulses which are amplified and then applied to the control of the screwdown motors. Similarly, the final thickness, as monitored by the X-ray thickness gauge, is checked to a prescribed value and any variations converted to pulses, amplified and applied to the control of the roll-motors.

In each case the length of individual correcting pulse is a function of the error signal in that the larger the error the longer is the duration of the correcting pulse. The preset space between adjacent impulses is the "sampling time" and the precessing of the screwdown motors or speed control regulator is, therefore, a series of impulses, equal in duration to the applied pulses and polarised in either direction.

An indicator (Fig. 2) tells the operator how rolling is proceeding and automatic adjustment takes place between the ranges of ±10% except for a dead band of ±2% where no control is needed. Outside the 10% limits it is assumed that the mill set-up is faulty.

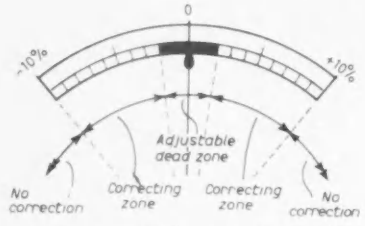

Fig. 2. Layout of X-ray gauge meter dial

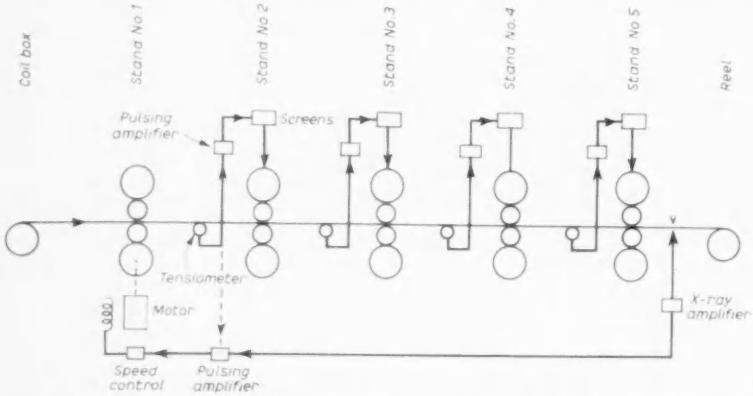

Fig. 1. Schematic arrangement of auto-gauge tension control on a 5-stand tinplate rolling mill

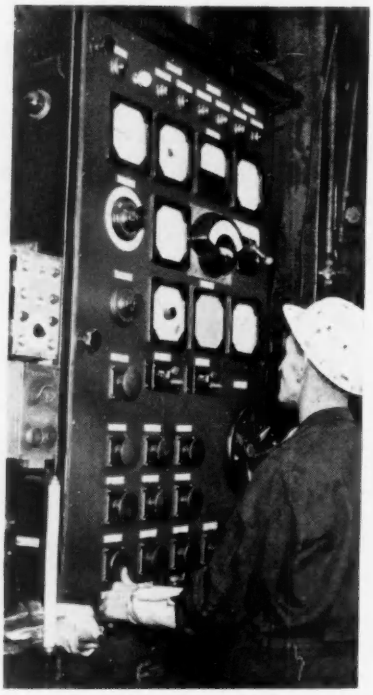

Fig. 3. Operator at the control panel of the auto-gauge tension control system

The sampling time can be adjusted to suit the rolling speed of the mill, but this is not an automatic operation since to make it so would unnecessarily complicate the circuit and the advantages gained are negligible. The only embellishments to the circuit are protective arrangements ensuring that the equipment automatically fails to safety.

The first stage, controlling the gauge by adjustment of the roll-motors, was completed in March of this year, less than four months after the first discussions. The subsequent developments on tension control have progressed in stages, one stand at a time, the final control having only just been completed.

Works Productivity Engineering Department reports show that, since the equipment was installed, the amount of off-gauge at the front end of the coil has been substantially reduced as well as off-gauge associated with welds. Further development work is in hand to simplify and transistorise the pulsing amplifiers with the idea of achieving a completely static control system. Work is also under way to apply the system to the four-stand cold-reduction mill.

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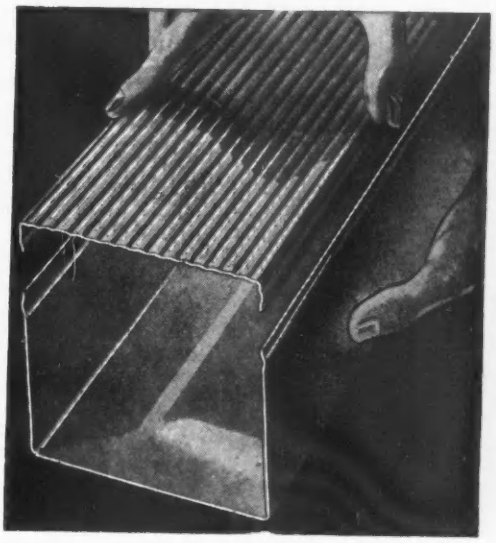

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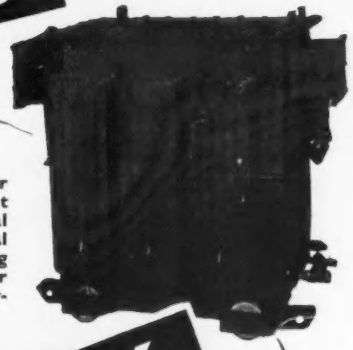

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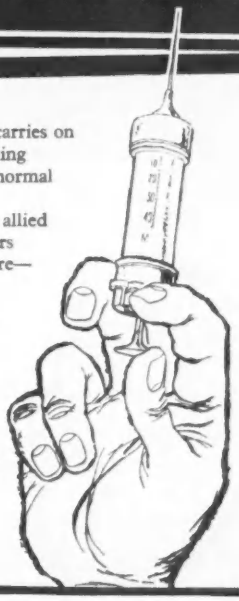

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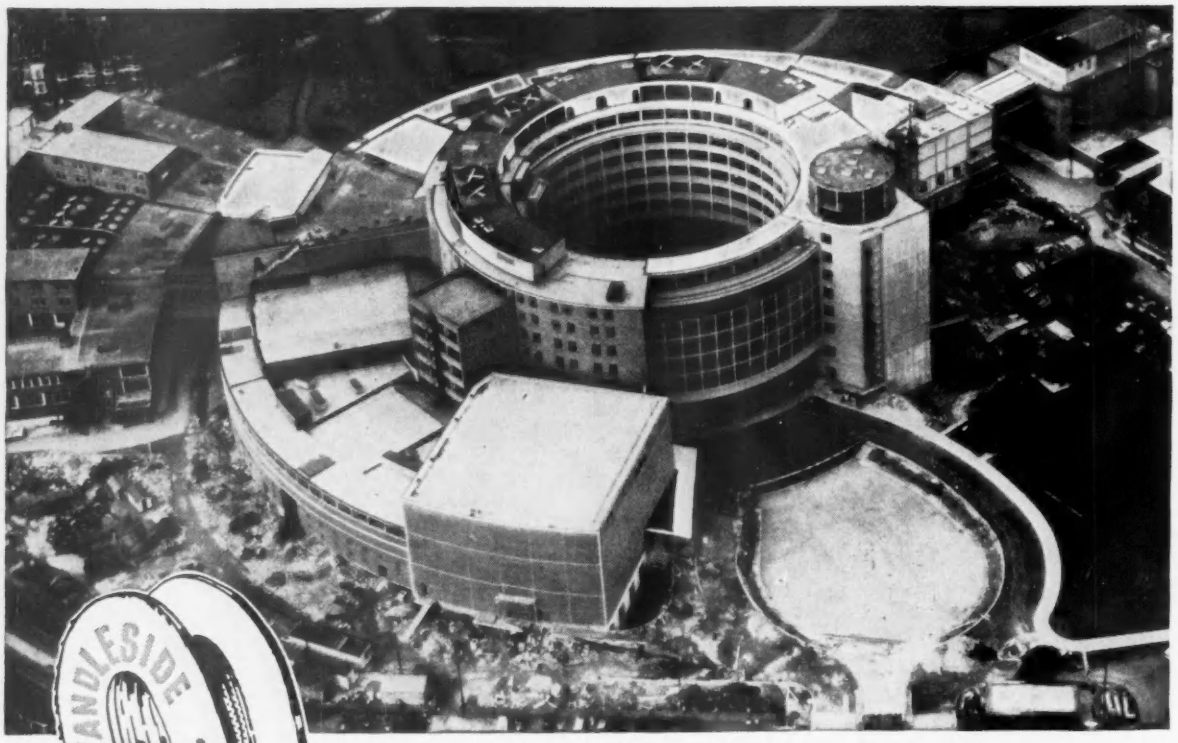

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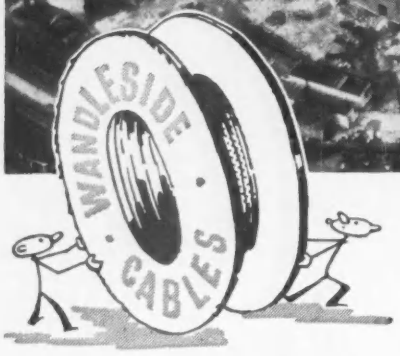

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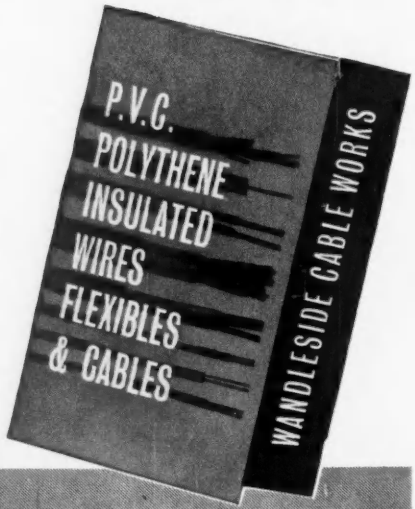

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Lighting in iron and steel works

ECONOMICS OF GOOD ILLUMINATION AND MAINTENANCE

ILLUMINATION of the working areas in iron and steel works presents special problems in that, for the most part, the height and length of the equipment—rolling mills, furnaces, etc.—necessitates the almost universal adoption of high-bay lighting. In addition, the high roof ambients, fumes and dust introduce a maintenance programme which, if not consistently carried out, can rapidly lower the overall level of illumination to inadequate values.

No one will disagree that all lighting must be good lighting for the conditions for which it is provided. The problem is to establish exactly what represents good lighting for particular environments. Lighting levels suitable for a furnace shop would, by any standard, be totally inadequate for a machine shop and it may conversely be argued that the levels for a machine shop are unnecessarily high for the furnace shop.

A number of published references can be consulted in relation to the lighting of steel and iron works and minimum standards are laid down by statute. These state that the general illumination over areas where persons are regularly employed shall not be less than 6 ft candles in a horizontal plane 3 ft above floor level or, in certain circumstances and where work is not actually being done, not less than 2 ft candles.

Both these figures must be taken as the absolute minimum and, in many cases, they are inadequate for the type of work being undertaken. It is left to the lighting engineer to establish the absolute minimum for safety and efficient production in these and in other areas not bound by statute. How may a satisfactory standard be assessed?

The Vital Factors

If we exclude the obvious factors, such as enough lighting to see the job by, freedom from glare and eyestrain, there still remains other less obvious factors which are, however, quite as important. These include lighting for environment and safety; lighting to standards established by experience and practice; costs, both initial and running; maintenance.

In regard to lighting for environment and safety, it goes without saying that all lighting must be sufficient to ensure safe conditions for operatives. This is not merely a function of illumination levels alone; it includes the avoidance of dark corners, confusing shadows and sudden contrasts which may divert or distract the operatives' attention. There is also the psychological effect and its influence on production. The level at the working surface may be adequate for the job and an increase in illumination may not show a corresponding increase in quantity output. At the end of a long day, however, the extra lumens, by reducing fatigue, will have assisted in a better maintenance of quality.

Experience and Practice

In any iron or steel works there are still many buildings in which the lighting intensity is of the order of 1 or 2 lumens/sq ft. Output in these buildings has been carried on satisfactorily for years and production records broken with monotonous regularity. The most plausible advocate of better lighting could not make a case on productivity alone, for records prove that the work can be carried on under such conditions. That is not, however, justification for retaining them; it may only be looked upon as a yardstick by which to judge the minimum level of lighting for that particular task.

Lighting is an amenity. The effect on an individual in passing from one part of a works to another must be borne in mind. The worker in the poorer lighted parts will always resent the conditions in a better illuminated shop, and with good reason. There is, however, no point in raising the standards above that necessary to preserve a degree of uniformity in lighting throughout the plant. Nor is there justification in raising the lighting level to those considered necessary for the drawing office and similar areas. Similarly, uniform lighting does not necessarily mean equality, for the melting shop does not need to be lit to quite the same intensity as a machine shop. The point is that it must *appear* to be so, which is quite a different matter. That is where the psychological approach comes in.

Cost

One of the most important factors is, of course, cost. But for this, all lighting schemes could be planned to simulate daylight conditions. It is fair to say that the best lighting scheme is a compromise between illumination and cost. The cheapest is not the most economic; the most expensive is not necessarily the best lighting. Many considerations enter into the picture not the least of which is the

This article is based upon a paper, "Some Aspects of Lighting in the Iron and Steel Industry," by D. R. M. Nisbet, in the *Journal of the Iron and Steel Institute.*

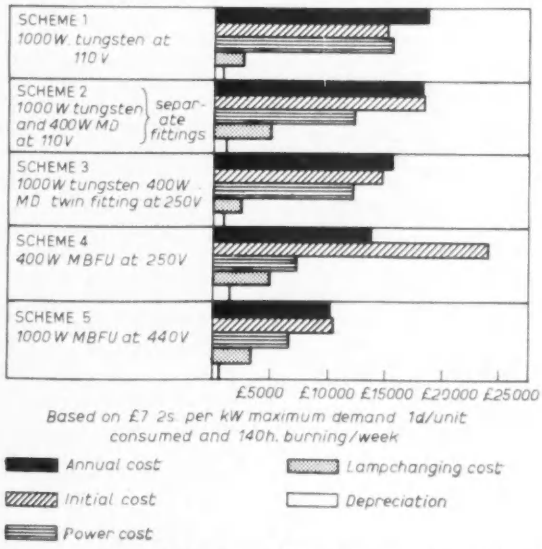

Fig. 1. Annual cost of selected installations showing constituent elements

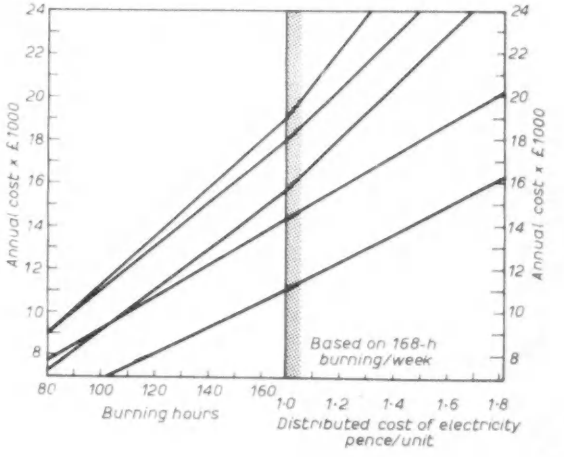

Fig. 2. Comparison of annual cost for different hours of burning and power cost. The graphs, in descending order, correspond to Schemes 1-5 in Fig. 1. The left-hand section is based on a distribution cost of 1d per unit; the right-hand section on 168 hours burning per week

effect on production. That good lighting can assist in output has been established time and again. It is not merely a simple matter of total lumens. The distribution, mounting height, choice of light source, voltage of supply, life of the lamps, frequency of cleaning and other factors all have to be taken into consideration, and an overall picture obtained before the lighting engineer—and the accountant—is satisfied that the best scheme has been adopted. Even then, some new development in light sources may change the picture in a few months' time.

Let us take, for example, an open-hearth melting shop and compare the costs for a number of different schemes of lighting on a basis of the same lumen output. This may not be strictly correct but it will be near enough for the five schemes which we shall consider.

The five are representative of the types of lighting mostly to be found in such workshops and in each case the costs have been estimated for initial cost, power consumption, lamp changing, including labour, and depreciation. In addition, the three latter items are summated to give an annual cost and the whole are presented schematically for comparison in Fig. 1.

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In the assessment, list prices of the fittings and lamps have been adopted while current costs are taken as 1d/unit plus £7 2s/kW maximum demand. The life of the fittings is assumed to be 15 years and that of the wiring 30 years. For maintenance purposes the burning hours per week are taken as 140 average with a life of 1,150 hr for tungsten filament lamps, 1,500 hr for the low-voltage mercury discharge lamps and 5,000 hr for the higher voltage types.

Fig. 2 shows the effects of variation in the number of burning hours per week and also the effects of increases in the cost of electricity running charges, on the basis of a 168 hr week, for each scheme.

From these two diagrams it is apparent that the item which most influences the annual cost is the power charge. A system with the lowest power consumption has a distinct advantage over others but this, in itself, is not the only factor to be considered.

Lighting Layout

A small number of high wattage lamps widely spaced apart might give an economical installation from the current aspect, but the general appearance of the lighting on the working plane would be "spotty" with alternating high and low level areas. Only in very high buildings are the heavier rated light sources economically applicable. For satisfactory distribution there is a minimum number of fittings which must be used, the first step in compromise between lighting effect and cost. For example, the lamps listed in scheme 5 would only be suitable for high-bay lighting though the remaining schemes are wider in application.

The choice of light source is also bound up with colour discrimination. It has been said that uncorrected mercury-discharge lighting is quite acceptable for steel and iron works since there is little need for colour discrimination with the work in hand. This, however, avoids the important psychological effect of the sickly appearance it imparts to the complexions of those working in the area. A degree of colour-correction which is introduced by the internal phosphor coating of the mercury-fluorescent lamps makes them a preferable alternative, but both types of lamp have the disadvantage of taking some time to come up to full brilliance after switching on. Should the current be momentarily interrupted, a cooling period is also necessary which may mean an interval of five minutes or so before full lighting is again possible.

This may be overcome to some extent in schemes 2 and 3 by the presence of the tungsten filament supplementary lighting, providing only that it is separately switched. Against the advantages of good colour rendering and instantaneous lighting of the tungsten filament lamp has to be set the shorter life and higher current and replacement costs.

Lighting Intensity

While good lighting is essential, overlighting is undesirable both from aesthetic and cost viewpoints. Excessively high values of lighting intensity are being called for in some steelworks and, in many cases, they could be halved without adverse effect on production or amenity. This, however, does presuppose good and consistent maintenance. Smoke and fumes condensed on the lamp envelopes and fitting reflectors, and dust deposited on the upper surfaces of the lamps, both of which are inescapable in steel and iron works, can rapidly reduce the light output by 50% or more. Extended maintenance may necessitate a higher initial lighting level to maintain efficient working levels at the end of each period but, economically, the capital and running costs of the higher level installation must be related to the maintenance costs. Unless it can be shown that the saving in maintenance charges is greater than the additional running and depreciation cost brought about by the adoption of the higher level, it is obviously uneconomic to adopt it.

In any case, maintenance, which includes cleaning and lamp replacement, cannot be extended beyond intervals set by the life of the lamp. The life of a tungsten filament lamp necessitates changing once every six or seven weeks which represents the maximum period for reflector cleaning. With gas discharge lamps several cleanings are essential in the course of its normal lifetime. Unless special access arrangements are made to enable the fittings to be serviced while work is in progress, the programming of the cleaning and replacement schedules must be carefully organised and consistently carried out.

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Good lighting is an expensive commodity though a necessary one. Providing that proper attention is given to maintenance, however, it is an investment which pays high dividends, not only in steel and iron works, but in every factory and office area. It is in the dirty atmospheres of the heavier metal working industries, however, that maintenance assumes its greatest importance.

Fluorescent Lighting

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The low watt loading of the 5 ft tubes, until comparatively recently the largest units available, necessitates multi-tube fittings in high-bay installations. Moreover, high ambients in furnace shops at roof levels may affect the life of the control gear unless special steps are taken to protect it. The greater economy as compared with tungsten filament lighting and the longer life, quicker starting and restarting as compared with the mercury and mercury-fluorescent lamps make them an ideal choice on every other ground. The introduction of the 8 ft 125 W twin and triple tube fittings may give rise to a reassessment of their value in high-bay lighting in the future. In regard to lighting output and taking average through life values, a three-tube fitting using warm white tubes would give some 22,800 lumens output as compared with 16,800 from a 400 W mercury fluorescent. Two such fittings, taking under 800 W, would compare with a 1 kW, 440 V mercury-fluorescent lamp.

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ONE of the fundamental decisions that has to be taken in design of a nuclear reactor concerns the fuel element cans; in what material shall they be made, and of what shape? Directly involved in that decision is the effectiveness of heat transfer that can be achieved from the can surface to the coolant gas, by using projections on "extended surfaces." This aspect of heat transfer was considered extensively at a symposium* organised last week by the Institution of Mechanical Engineers. The factors applying were reviewed in a paper by Mr H. H. Gott (Nuclear Plant Design Engineer, CEGB) and others, with which this summary is mainly concerned.

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Magnesium alloys, although decisively attractive from the nuclear aspect, have many disadvantages, including poor high-temperature mechanical properties, which limit gas temperature and exercise a big effect on the efficiency of the associated steam cycle.

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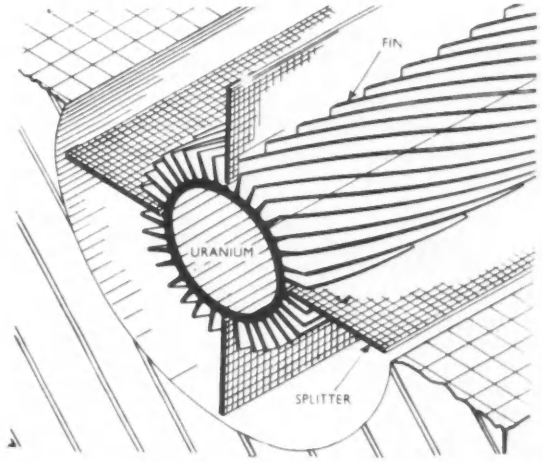

Typical fuel element for CEGB reactor in its channel (after A. F. E. Wise)

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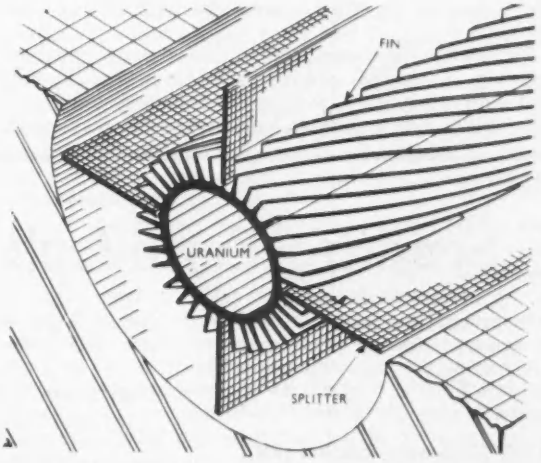

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for electricity supply in the UK is helical finning in conjunction with axial longitudinal fins to break up the flow into distinct axial troughs; or what is very similar in effect, longitudinal finning with helical splitters. Optimum number of splitters is about four. Interaction between fins and splitters sets up a vortex motion that gives a good interchange of gas between the inter-fin and free-flow spaces. Design is largely experimental, and apparently superficial differences can produce an effect on heat transfer performance that the authors note as "surprising."

An example of the results that those concerned with fuel element development still find unexpected is that the sharp edges left on machined fins lead to heat transfer significantly improved in comparison with that obtained with extruded finning of the same nominal dimensions.

Away from heat transfer considerations, thought has to be given in fuel element can design to what will happen to the lowest fuel elements in a stack when those above them are removed. There is a risk that the rush of coolant will blow them bodily out of the reactor core. If this happened there would be some risk of damage, and a more serious possibility that it might be difficult to remove the elements concerned. In some reactor designs, self-weight of the fuel elements is kept high enough to prevent this happening, in others special structural arrangements are made.

Extended surfaces are used in nuclear power stations, not only on the fuel element cans but also on the heat exchanger tubes. Here, their use is forced by economics; the nuclear station heat exchangers have to be compact compared with ordinary boilers because of the high cost of the pressure shell, and they have to work with a smaller temperature difference. The technique used is to weld on continuous close-coiled helical strip or studs, and plates of various configurations. Once again, a careful optimisation investigation is required to balance advantages against such contrary factors as gas-side pressure loss and increased capital cost caused by use of extended surfaces.

Future Developments

Looking to the future, the authors suggest two possible developments not yet included in any of the CEGB reactors; but they warn that increases in rating which remain possible in magnesium alloy fuel elements are not very large.

The first of the suggestions is for use of channels in the graphite core whose cross-sectional area varies along the length so that flow velocity is everywhere approximately matched to local rate of heat release. This allows some fuel elements which would otherwise run rather cool to be operated with a surface temperature far nearer the designed value. The channels in the core would presumably be stepped as a means of varying the diameter, and this would introduce an increased risk of fuel elements jamming.

The other idea is to use fuel elements with increased fin tip diameter, with the root diameter increased also, so as to obtain improved fin efficiency. This is likely to necessitate use of hollow uranium fuel rods to avoid excessive temperatures at the centre of the uranium.

Sensitive Earth-fault Relay

INCREASING demand for refinements in relay technology are illustrated by two recently developed relays shown by English Electric at their meter and relay exhibiton held recently in London.

High Resistance Earth Fault

The first relay is intended to trip circuit-breakers should a high resistance earth fault occur on 11 kV or 33 kV rural distribution lines. The relay has a minimum setting of 0·1 A corresponding to 2% of normal full load when a 5 A c.t. is used. The unit incorporates an adjustable timer to ensure that the main earth fault protection system has time to operate.

The unit, type CMU, consists of a sensitive polarised relay, fed from existing protection current transformers through a rectifier and saturable auxiliary c.t. By using a polarised relay, good mechanical stability is obtained with a relatively small operating differential. The object of the saturable c.t. is to limit current flowing through the polarised relay on overload. It enables the relay to be rated for overloads of 100 A for 10 sec to 200 A for 2½ sec. Since the burden of the c.t. is only 0·005 VA, it imposes practically no extra burden on an existing protection installation.

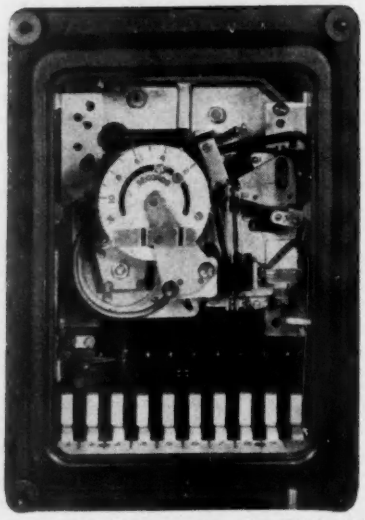
Two types of the relay are available for either self- or hand-reset, with contacts rated for 1,250 W and with either 5 A or 660 V d.c. maximum.

Single Shot Auto-reclose

An auto-reclosure scheme was also displayed. This scheme uses standard relays to provide a limited number of circuit-breaker operations before locking out. If a fault occurs on a system, the "single shot auto-reclose" scheme allows a single reclosure. If the fault is transient and the line is again healthy, the scheme resets in readiness for the next operation. If, however, the fault persists, the scheme locks out the breaker after the second clearance. The scheme includes a counting relay which can be arranged to lock-out the breaker after a predetermined number of fault operations between one and ten, and which can also be used to give indication that maintenance on the breaker is required. A timer unit allows reclosure with a dead time adjustable between 5 sec and 30 sec and a reclaim time up to 30 sec.

This scheme is applicable to both motor-wound, spring-operated and solenoid-operated circuit-breakers.

The exhibition, which is visiting various centres, also contains several products of the company's progressive instrument division. The insulated case instruments were extended in the past year to include moving iron meters. Features of other meters were a movement which can be removed without loss of sensitivity for maintenance and a moving iron instrument with expanded lower scale reading giving accurate reading from 5% to 20% f.s.d.; a development intended for applications where future load growth is anticipated.



The English Electric relay type CMU will detect high resistance earth faults on 11 and 33 kV distribution lines. Overcurrent protection is included

Electricity in aircraft

I.E.E. AND R.Ae.S. JOIN FORCES IN SERIES OF DISCUSSIONS

THE tremendous growth in electrical equipment and services on military and civil aircraft in post-war years has imposed a considerable strain on the aircraft industry. Electricity is no longer a subsidiary and relatively unimportant part of an aircraft's power system; it is a vital contribution to aircraft safety, navigation and control without which no airliner, fighter or bomber could fly today. In Britain the aircraft industry has, for far too long, ploughed its own lonely field in developing the systems and equipment, depending largely on the experience of component manufacturers—many of whom have themselves grown up in the low voltage automobile industry—and on imported experience and equipment from the USA.

Until a few years ago there was a tendency to look down on electrical engineers who were engaged on the work of catering for the aircraft's needs as being of small account. In the industry they were often on the chief draughtsman's staff with little authority of their own; in the wider profession their position and experience was, of itself, not considered sufficient qualification for corporate membership of the IEE. In America, though, the electrical side of the industry had already justified the formation of a special body within the AIEE.

By 1955 there had grown an awareness of the responsibility which such engineers were shouldering, the amazing breadth of specialised knowledge in d.c. and a.c technology and in electronics which they had to possess and the peculiar environmental conditions which coloured each and every one of their problems. In May, 1956, the first joint get-together of the two institutions, the Royal Aeronautical Society and the IEE, took the form of a symposium held in London at which it became clear that, in the future, there would have to be closer co-operation between the two professions if the best solutions to the ever increasing electrical problems were to be attained without excessive dependence on American practice.

The second step, logically an extension of the discussions which had continued between the two bodies since that first symposium, opened last Friday with a joint meeting at the IEE at which both the president of the IEE, Sir Hamish D. MacLaren, K.B.E., C.B., and of the Royal Aeronautical Society, Dr E. S. Moult, C.B.E., B.SC., M.I.MECH.E., were present. In a well filled assembly, Viscount Caldecote, D.S.C., M.A., M.I.E.E., presented a lecture which was intended as an introduction to a series of joint discussions on future trends in airborne electrical and electronic equipment.

Present and Future Trends

In a summary lasting just over an hour, Lord Caldecote touched briefly on every aspect of electrical service in aircraft and guided missile engineering with position to date and the problems to be faced as speeds, in the case of manned aircraft, passed Mach 1, approached Mach 2 and even Mach 3. Cables, already being upgraded for higher temperatures with silicone and p.t.f.e. insulation, might have to be mineral insulated. Generator drives would depend upon the choice of system, 28 V d.c. remaining for smaller range civil airliners and private aircraft, but changing over to 220 V a.c. on larger, long-range machines. Whether it would be constant or variable frequency would depend both on the application and future technological developments. Frequency-wild systems were adequate for heating and de-icing circuits and, by the use of semiconductor rectifiers and batteries, could also be applied to relay operation and motorised services. They did not need comparatively heavy constant speed drives which, however, were not yet at the end of their development.

Constant frequency systems had enjoyed a vogue in recent years and could be operated either as separate or paralleled systems. Their value lies in that the many motorised applications could be carried out with brushless motors so avoiding brush problems at high altitudes and, in addition, constant frequency was required for many electronic devices. The development of the semiconductor inverter might, however, change the position in that constant frequency supply might be attainable at less weight from a rectified d.c. source.

The development of many electronic devices on missiles had contributed much to both manned and unmanned vehicles. In the civil and military aircraft fields weight was an ever present problem. The space limitations in missile development had resulted in micro-miniaturisation techniques which would be invaluable in aircraft. The higher speeds of aircraft introduced problems of navigation and collision risks which necessitated speeds of decision and action rapidly approaching the limits of the human being. Electronic control and computer devices are essential to the future of high speed transport. In a survey of navigational systems he mentioned the conflicting claims for the VOR/DMET and Decca systems.

Touching on the direct generation of power, there were the possibilities latent in current developments of gas or nuclear heated thermoelectric cells, fuel cells and allied devices. Without looking too far into the future the number of immediate problems to be solved, all of which must have the inherent quality of reliability, necessitated close co-operation not only within Britain but throughout the Western world or we should not be able to maintain our competitive position against Russia and her satellites.

DISCUSSION

In the discussion which followed, many prominent members of both institutions took part. MR C. G. A. WOODFORD opened by taking up the speaker's final words. We would all like to know what Russia was doing in this field. She has obviously made astounding progress. On the subject of computers, was there not an element of vulnerability in the multi-wiring systems? SIR GEORGE EDWARDS, managing director of Vickers-Armstrongs (Aircraft), emphasised the essential quality of reliability in all aircraft electrical equipment. DR WILSON referred to the failure rate for missiles and said that this was too high for aircraft. MR H. ZEFFERT stressed the importance of co-ordination between electrical and mechanical engineers in the design stage. Electrical equipment was only as reliable as the associated mechanical devices. Others contributed and LORD CALDECOTE briefly replied.

equipment for industry

Nylon cable glands

BY increasing the length of the body screw to ¼ in. the range of application of "Elkay" nylon cable glands has been extended to accommodate up to ¼ in. thick plate. These are made up of four parts: rubber gland, metal washer, body and gland-clamping bush, the latter components being moulded in shock-resisting nylon compound. Available in black or white, sizes range from ¼ in. dia to 1¼ in. dia. Nylon locknuts can be supplied if required. In the same range are polyethylene insulating bushes for cable diameters up to 9/32 in. *Elkay Electrical Mfg. Co. Ltd., 42 Woburn Pl, W.C.1.*

Closed-circuit TV equipment

A CLOSED-CIRCUIT television installation costing £335 consists of a camera unit incorporating the power supply. The camera uses a Vidicon pick-up tube having a resolution equivalent to 2·5 Mc/s on the 405-line system. The standard f1·9 lens supplied has a 28° horizontal angle, but wide-angle and telephoto lenses are available if required. The camera is claimed to be suitable for use in conjunction with the majority of 405-line commercial receivers acting as monitor. *Nash and Thompson Ltd., Oakcroft Rd, Chessington, Surrey.*

Governor-controlled motors

OF particular note among a range of precision components for aircraft and other instrumentation systems are a.c.- and d.c.-governed motors. The a.c. motor is a three-phase induction type with wound rotor having a nominal speed of 1,500 r.p.m. at 50 c/s, 230 V, with an output of 20 W. Speed is held constant against supply and load fluctuations by centrifugal governor-operating contacts in the rotor circuit. Thus, a supply voltage variation of 13% causes only a 0·3% speed change, and a 12% load change affects sped by 0·2%. Manual speed control of ±100 r.p.m. is effected by mechanical adjustment of the magnetic circuit. A suitable application for the motor is in high fidelity magnetic recorders. The d.c. motor is available for 12 V and 24 V supplies and has an output of 6 W at 3,000 r.p.m. Speed regulation of 1½% is maintained for a load fluctuation of 40% of full load, and 2½% regulation for supply voltage variation of 40%.

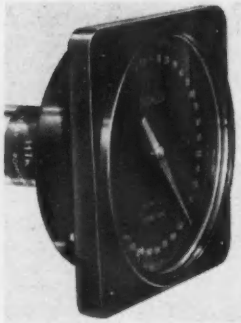
Various additions and amendments have been announced for the range of components mentioned which includes such devices as acceleration inductance transducers, pressure switches and capsules, and synchronous torque transmitters. *Kelvin and Hughes Ltd., New North Rd, Barkingside, Essex.*

Remote dial indicator

UTILISING the a.c. synchronous torque transmission principle, a remote dial indicator unit registers angular or linear readings received from a corresponding transmitter at the source of information. The standard model has a 3 in. dial calibrated from 0° to 360°, and reads to an accuracy of ±1°. A square flange is provided for panel mounting and alternative calibrations can be supplied to suit individual requirements. Models are available for either 50/60 or 400 c/s transmission frequency. *Ketay Ltd., Eddes Hse, Eastern Av. West, Romford, Essex.*

Multi-purpose wrench

A MULTI-PURPOSE tool which should find wide application in electrical assembly and maintenance work, combines the functions of a spanner, pipe-wrench and wire cutter. 12 in. long and weighing 2½ lb, it will accommodate nut sizes up to 2 in. and cut ¼ in. diameter wire. Of chrome-vanadium steel, the tool is said to give hard-wearing service. *Bowthorpe Electric Co. Ltd, Crawley, Sussex.*



◀ *Ketay remote dial indicator registers angular displacement from 0—360°*

Multipurpose tool can be used as a spanner, pipe wrench or wire cutter. Distributed by Bowthorpe Electric Co. Ltd. ▶

Miniature electrolytic capacitor

A RECENTLY introduced range of miniature electrolytic capacitors are of etched foil construction and contained in an aluminium can ¼ in. long by ¼ in. diameter. They are designed specifically to give low impedance at frequencies of 10 kc/s and above; they also offer internal resistance of less than 0·2 ohm. They are thus claimed to be of particular use in transistorised computer circuits dealing with pulses in the order of a microsecond duration. Capacitances range from 200μF at 3 V to 12μF at 150 V. Maximum working temperature is 40°C while best power factors are obtained at −40°C, a typical value being 0·5 for the 40μF 25 V rating at the latter temperature. *The Plessey Co. Ltd, Ilford, Essex.*

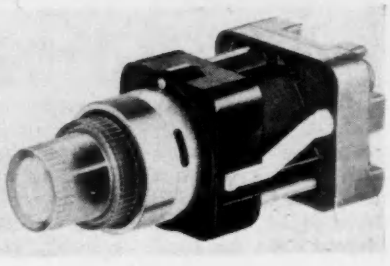
Magnetostriction delay line

DELAY lines in which a mechanical pulse, magnetostrictively induced, is transmitted along a wire have been used in computers and allied devices for several years as storage and time delay elements. Now it has been possible to develop a device as a standard unit which can be incorporated in a line to give variable delays between 2 microsec and 10 millisec with a digit rate of up to 500 kc/s and fluctuation in delay time of under 1 millimicrosec.

The device comprises a magnetostrictive element and a transmission line, the effective length of which is adjustable through a low torque, recirculating ball race drive. Manual or servo operation can be applied and micro-limit switches are fitted. *Ferranti Ltd., Hollinwood, Lancs.*

Illuminated push-button

FOR use in conjunction with heavy-duty contactor control gear, an illuminated push-button unit incorporates its own miniature transformer for supplying the 6 to 8 V pilot lamp. Operation of the push-button closes a pair of contacts. One, rated at 6 A, is for controlling the external contactor circuit, the other for the internal lamp circuit. With this arrangement the pilot lamp remains alight only when the button is held depressed; however, by suitable interconnection it can be made to indicate whether the external circuit is open or closed. The push-button lamp lens is available in four colours in addition to clear and opal white. Supply voltages catered for range from 110 V to 600 V a.c. *Square "D" Ltd, Cheney Manor, Swindon, Wilts.*



Square "D" illuminated push-button ▶

for the electrical trade

Deep freeze 'fridges

THERE is no uncertainty over the "deep freeze" claim by Kelvinator for their "Zero-plus" freezing compartment. This new fixture—a standard in their 1961 range—maintains a temperature of between zero and 5°F, a level which meets with the satisfaction of major ice-cream and frozen-food producers. Furthermore, the remainder of the space in a refrigerator equipped with "Zero-plus" remains at approximately 40°F—a safe temperature for foods like fruit and vegetables.

A brand new model is the highlight of the range, the "Lady K" 3·1 cu ft version. In addition to the freezing compartment, this model features three sliding shelves, interior lighting, separate dairy compartment and magnetic door fastening. It requires a modest floor area, 19 in. by 19 in. and can be wall-mounted, built-in, or freestanding. A free wall-mounting kit will be supplied by Kelvinator any time after purchase. The remainder of the range retains last year's prices, though all models now incorporate the new freezer. Compressors are guaranteed for five years.

Price of "Lady K" is £52 10s, tax paid. *Kelvinator Ltd., Gt. West Rd, Chiswick, W.4.*

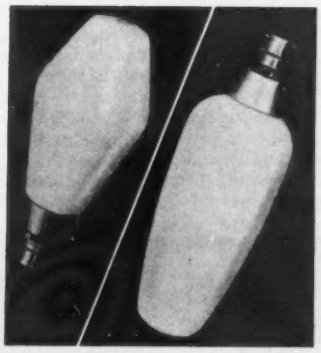
A new light source

INTEREST in the possibility of electroluminescence for domestic illumination was aroused in America recently by its being used in two panel night-lights. The main advantage of the new light source is its low—if not negligible—current consumption. Now, a switch, or socket-outlet locator, which employs the principle has appeared in MK's new accessories catalogue, and it is probably its first domestic application in this country.

The locator is a mounting panel, which takes any fixture having 2⅛ in. fixing centres. It emits a green glow sufficient to silhouette the switch or socket. The panel comprises the 3¼ in. by 3¼ in. illuminating surface, enclosed in a transparent frame, with connecting leads and resistor. The locator appears white during daylight, adding a decorative touch as well as an incidental protection against finger-marks on the wall. Price is 5s 8d list. *M.K. Electric, Shrubbery Rd, N.9.*

New lamps need no shade

A COMPLETE breakaway from the familiar style of domestic tungsten lamp is shown in the new 60 W "Fantasie" model, designed for installation without a shade. It is large for a domestic lamp—about 9 in. long—and so far is available in two shapes, one long and smooth, the other slightly angular. Surface is opaque "Argenta" white. The gold anodised cap extends 2 in. over the envelope, imitating a semi-decorative lamp holder. The new lamp, recommended for installation in bedrooms or hall-ways is, in fact, its own decorative fitting. Price 12s 6d, tax paid. *Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.*



Philips' new "Fantasie" lamps fulfil the functions of decorative fittings and need no shades. Price 12s 6d, tax paid

Panels for skirting heating

SKIRTING heating is the latest application of "Morheat" low rate warming panels. These panels, which are being used in an increasing variety of products, comprise "Mhoglass" non-metallic mesh-type elements sandwiched between boards of Swedish Masonite. The skirting sections are panels 4 ft long by 8 in. high, mounted in capping boards. They are easily fixed with metal brackets supplied. Rating is 200 W per section; price, £5 5s.

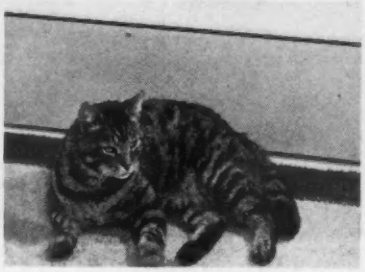
New "Iced-Diamond"

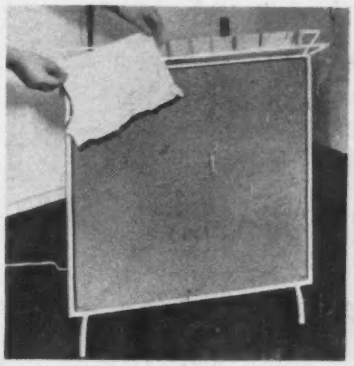
A NEW 53 gn version of Hotpoint's "Iced-Diamond" 3·7 cu ft refrigerator is being delivered to the trade this week. The main difference between this ES37 model and the existing E37 Super is that the new model has no kick-strip, interior light, rollers, butter dish or salad bin, and is available only with a right-hand hinged door. It is available in white or cream cabinet with white polystyrene liner. *AEI-Hotpoint, 33 Grosvenor Pl, SW1.*

New commercial tube fitting

AN entirely new range of fluorescent fittings for commercial and industrial use are introduced under the name "Streamlite." They feature extremely light and slim channels, hardly deeper than the tubes themselves. The 5 ft 80 W models are available for one, two or three lamps and the 2 ft and 4 ft with one or two. They can be supplied with switch-start or switchless start apparatus and all are suitable for single or continuous mounting. A wide range of diffusers and reflectors is available. *Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.*

"Lady K," latest Kelvinator 'fridge. It has a "Zero-plus" freezing compartment





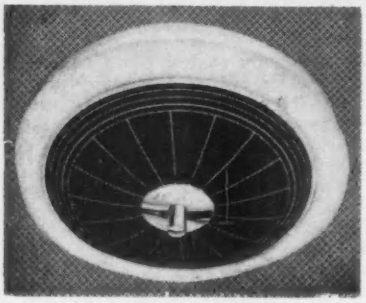
Above: The "Morheat" drying panel—a further application of the "Mhoglass" heating element, £9 9s. Left: Skirting sections of Morheat boards are easily installed and sell at £5 5s tax paid

Lights for Christmas

DESIGNED for the smaller Christmas tree favoured in most homes, the new "Lilliput" sets of fairy lights sell at £1 9s for 20. They consist of small jewel bulbs coloured blue, green, red, yellow and white, set in small rosettes at 9 in. intervals along the flex. These lights, which need not, of course, be confined to a tree are said to be long-lasting, safe and easy to replace. The failure of one does not extinguish the whole set. An attractive packing has been designed for point-of-sale appeal—the lights are clustered so that they project from the apex of a gaily coloured cardboard pyramid. This mount fits within an attractive outer container. The set of 40 bulbs is available at £2 9s 6d. Another Christmas idea is a 22 in. high tree fitted with 20 bulb candles. It sells at £1 18s 10d. All prices include tax. *The General Electric Co., Osram Lamp Divn. Magnet Hse, Kingsway, W.C.2.*

Circular fluorescent fitting

EFFECTIVE use is made of the circular fluorescent tube in a domestic ceiling fitting, "Ringway." The tube remains unobscured, but the circle it forms is filled by a shallow glass bowl of black, yellow or red. A chromium-plated bush secures this centre-piece and is easily unscrewed to provide access to fixing holes and control gear. "Ringway" may be flush-mounted, but provision is also made for chain suspension. There are three models priced as follows: 8½ in. dia, 22 W, £3 19s 6d; 12 in. dia, 30 W, £4 7s 6d; 16 in. dia, 40 W, £4 17s 6d. *Hounslow Heath Electrical, 375 Staines Rd, Hounslow, Middx.*



The novel "Ringway" fluorescent tube fitting up to £4 17s 6d

TRADE PUBLICATIONS

MARRYAT-SCOTT.—24-page coloured brochure on lifts, escalators and paternosters by Marryat-Scott Ltd., Wellington Wks, Hounslow.

E.E.—28-page technical booklet on E.702 Storage Tubes. English Electric Valve Co., Chelmsford.

LUCAS.—Pamphlet on a 12 volt alternator set for cars and commercial vehicles. Birmingham.

VACTRIC.—Broadsheets on following units, giving detailed technical information: 08 a.c. motor; 10, 15 and 08 a.c. motor tacho-generator; 11 a.c. induction motors; 11 a.c. temperature compensated motor tacho-generator; 07 d.c. motor; 11 and 15 d.c. split-field motors; 11 d.c. tachogenerator. Vactric (Control Equipment), Vactric Hse, Sloane St, S.W.1.

T.I.—Brochure describing a wide variety of extended surface tubes by subsidiary companies of Tube Investments Ltd., The Adelphi, W.C.2.

ATLAS.—Booklet on flash photography. "Get the best results with Tru-flash," 27 pp. Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.

OSMOND.—Pamphlet illustrating a representative range of cut-off machines and pamphlet describing in detail Model O/10. A. and S. Osmond, 13 Dowry Sq, Bristol 8.

LESSER.—Leaflet: "Progress in Prefabrication 6"—cedar cladding: red cedar exteriors. J. E. Lesser and Sons, Green La, Hounslow, Middx.

KELVINATOR.—12-page booklet with cartoon illustrations entitled "How to Choose a Refrigerator." It gives details of their "Zero-plus" freezing compartment in the new range. Kelvinator, Chiswick Flyover, Gt. West Rd, W.4.

ERICSSON.—Technical pamphlet on Microsignal Chopper Type D. Ericsson Telephones Ltd., Electromechanical Division, Beeston, Nottingham.

S.T.C.—News Bulletin Vol. 7, No. 1, October, 1960. Standard Telephones and Cables Ltd., Connaught Hse, Aldwych, W.C.2.

Improved Lighting at Liverpool Street

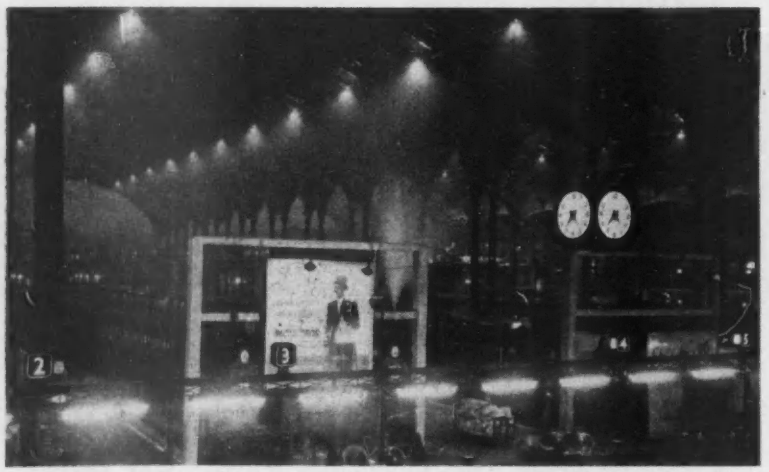
ON the eve of inauguration of London's recently electrified north-eastern suburban railway, an entirely new lighting scheme for Liverpool Street station has just been completed. Results have been dramatic; illumination has been increased five-fold from the dingy 1 lumen/sq ft provided by the original soot-covered tungsten-filament spherical fittings. Improvement of lighting amenities for this station was long overdue. Also, adequate illumination would increase passenger handling efficiency demanded by the expected rise in traffic on electrified lines. Electrification would itself ameliorate the problem by the consequent reduction in light-absorbing smoke haze; in fact, required illumination has been obtained with only 40% additional power consumption.

Harmony with the architecture of the existing station structure was one of the aims in designing the new lighting scheme. This, it was felt, could be best achieved by placing lighting fittings as high as possible to avoid the oppressive effect of an unlit roof-space. Colour-corrected high-pressure mercury discharge lamps were chosen for the main overhead lighting. Besides being economical in power consumption, their long life would reduce maintenance costs. Plain mercury vapour and sodium discharge lamps were not acceptable because of poor colour rendering and the possibility of confusion with track signal lights.

The lamp fittings, mounted in dispersive reflectors, are chain-suspended from hinged access hatches which replace the original roof-light panels. They are spaced at 60ft to 70 ft intervals, mounting height being 60 ft to 65 ft. Wiring runs along the top of the station roof, connections to individual fittings being via 5 A. three-pin plugs and flexible leads from cast-iron control boxes introduced into the main conduit runs.

The provision of subsidiary lighting, such as for ticket barriers and parcel concentration areas, is achieved by cold-cathode linear discharge lamps. These also illuminate open platforms where they are mounted at 11 ft 6 in. on specially designed concrete columns.

Station lighting control is effected by two three-phase 30 A contactors housed in the main power supply circuit-breaker cubicles. The contactors are remotely operated from two points in the station building. Should there be a failure of the main supply, there is arrangement for switching in the London Transport Executive's 33⅓ c/s supply.



New lighting at Liverpool Street station. Colour-corrected mercury vapour lamps mounted high overhead emphasise cathedral-arch effect of roof supports

Inspection Council progress

N.I.C.E.I.C. PRAISED BY HOME OFFICE MINISTER

TRIBUTE to the work of the National Inspection Council was paid by Mr D. Renton, Q.C., M.P. (Under-Secretary, Home Office), speaking at the luncheon which followed the Annual General Meeting of the NICEIC. Mr Renton said the Home Office had traditional responsibility in connection with public safety, and from this aspect was most interested in the work of the National Inspection Council. The Council was based on voluntary co-operation with no statutory backing, yet it had a vital part to play with respect to public life. Its non-statutory nature did not mean it was less appreciated in Government circles.

Mr Renton suggested that the success of the NIC rested on three pillars: the electricity boards, the ECA, who had helped by advising members to enrol, and the IEE, who provide a readily recognised standard which the NIC could recommend for wiring installations.

The time was right for the NIC to extend its efforts further and attract the interest of the public more widely. More than 20,000 copies of the roll of the NIC had been printed. This was almost Penguin numbers, and he was sure that it satisfied the test of the public good. It was a good thing to get public authorities to set an example in matters such as employing only approved contractors; if public authorities did so, others would be encouraged to do the same.

Mr Renton noted that 1959 was the worst year in Britain's history so far as fire losses were concerned. A large number of fires were caused by faults in electrical installations. The Home Office was most anxious that the fullest possible use should be made of lessons learned from such fires. In some cases there was a fault in the use of electricity which could have been overcome by care in installations.

The reply to Mr Renton was made by NIC chairman Mr C. T. Melling (Electricity Council). He noted that the NIC had appointed an additional inspecting engineer in an attempt to improve regularity of inspection of established contractors. Work was compared with the IEE regulations in their full demands. Some 27,000 inspections had been made to check that work of enrolled contractors was of high quality. However, there were many contractors not yet enrolled. The Council was doing its best to attract them to its membership. It was in their interests to become enrolled, because more and more local authorities were requiring membership before placing contracts.

On the subject of fires, Mr Melling said the NIC was very conscious of the trouble caused by bad electrical installations. In this respect not only the quality of the installation was important, but its comprehensiveness. The electrical demand doubled every 10 years, the number of appliances could increase still faster. In order to be sure that all types of accidents were reduced the Council was keen on an increase in number of socket-outlets in rooms so that the electrical installations could have "flexibility without flex."

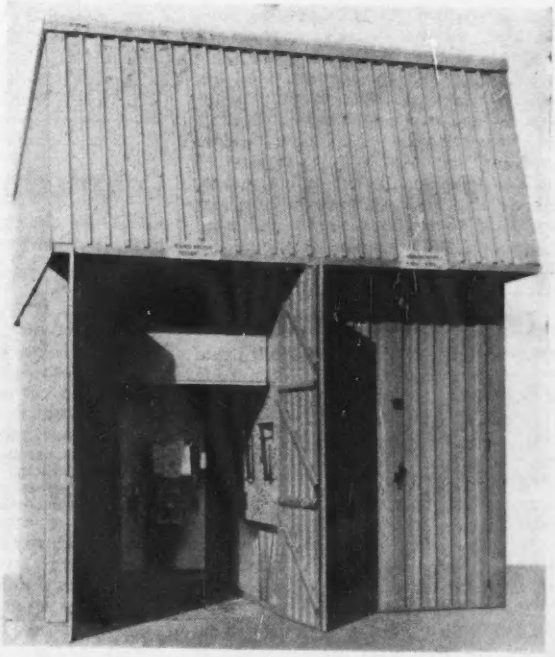
The annual report of the NIC showed an income of £51,469 during the year ended 31 March, 1960. Salaries and related expenses took £31,070, travelling and general expenses £13,400. At the end of the year there were 3,694 contractors (including area boards) on the roll, at 5,310 operating addresses.

PACKAGED SWITCHGEAR

CLAIMED to occupy little more space than a conventional indoor installation, the "Weatherbeater" packaged switch station now being marketed by English Electric Co. houses 33 kV switchgear. Unpainted aluminium is used for cladding and only a simple concrete raft foundation is needed for the switchgear. Built from standard units, each 16 ft 9 in. high by 12 ft 3 in. deep, a switching station can be assembled to give the required switch arrangement.

Each building unit houses either an EE Co. single-tank o.c.b. for 1,200 A or for 2,000 A. Single busbar, for 750 MVA and 1,000 MVA short-circuit ratings, is the arrangement available. Isolation is by means of hand-operated isolators on both sides of the circuit-breaker. Built-in cable equipment is provided, together with busbar earthing equipment where appropriate.

The packaged station has all the interlocks usually provided with metal-clad gear. Isolators, earthing equipment and shutters are all operated from a single point mounted at the side of each unit.



There are two 33 kV equipments in this "Weatherbeater" unit

News of the Week

WINDING-UP FOR VACTRIC

Appeal for more time rejected

THE Vactric domestic appliance business is to be wound up. On Monday, Mr Justice Pennycuick in the High Court made an order for the compulsory winding-up of Vactric Ltd, on a petition by Wilson Advertising Ltd, of Manchester, who claimed a debt in respect of advertising for £105,379. He refused to grant a three-week reprieve in order that a statement of affairs could be produced. For Vactric Ltd, Mr L. J. Morris Smith claimed that this statement should disclose a position on which proposals might be based for the unsecured creditors—proposals either for a composition or a moratorium which would produce more benefit for them than a winding-up order. He asked leave for hearing out of time of three creditors, with aggregate debts of about £390,000, who wished to oppose the petition.

The draft accounts for last year showed a loss of over £100,000, he went on, but book values showed a considerable excess of assets over liabilities of about £1 million, he maintained. The company was financed as regards liquid capital by a bank which held a debenture. On 7 Oct. last the bank appointed a receiver and manager under its debenture.

It was also announced on Monday that Mr A. J. Barsham, a director, had resigned from the board.

Liabilities of Vactric (Manufacturing) Ltd. amounted to £838,000, it was revealed at last week's meeting of creditors of that concern, the subsidiary of Vactric Ltd., who manufactured the washing machines. Of that sum, £551,000 was due to the parent company, £251,000 to trade creditors, £3,000 to expense creditors and £33,000 in respect of claims for cancellation of contracts. Assets of Vactric (Manufacturing) were estimated to realise £161,000 and, after allowing £34,000 for preferential claims, there were net assets of £127,000.

Mr J. W. Margetts, C.A., of Peat, Marwick, Mitchell and Co., receiver for the debenture holders of Vactric Ltd., reported that the manufacturing concern had suffered as the result of the decline in the demand experienced by the trade generally, and trading figures showed that for the year to 31 March last there was a loss of £64,000. The period 1 April, 1960, to 4 Oct. resulted in a further loss of £191,000. It was decided to appoint Mr E. R. Nicholson, of Peat, Marwick, Mitchell and Co., and Mr A. T. Eaves, of Harry L. Price and Co., Manchester, as joint liquidators, with a committee of inspection.

BID FOR BENHAM

GLOVER and Main Ltd. are going into the catering equipment business in a big way. Earlier this year they acquired for £1·1 million cash all the capital of James Stott and Co. (Engineers) Ltd., and now they have made a bid for the capital of Benham and Sons Ltd. For the latter concern they have offered £244,000 cash plus the allotment of £732,000 unsecured 6½% loan stock, 1964. Benham's, whose issued capital consists of 244,000 £1 Ordinary shares, made a group profit of £129,854, before tax, for the year ended 30 Sept., 1959, and their consolidated net assets at that date were valued at £837,582.

Late Deliveries—B.E.A.M.A. Statement

BEAMA have informed us that they now understand that the late deliveries referred to by the Australian High Commissioner in his speech at the Electrical Engineers' Exhibition Dinner related to plant arriving late irrespective of civil engineering difficulties. In these circumstances they recognise that their comments reported in our 20 Oct. issue were not relevant to this case and were, therefore, inappropriate in the context of the High Commissioner's speech.

Tariff Rise Likely

HIGHER tariffs in the eastern area from next April were foreshadowed at the Eastern Electricity Consultative Council's meeting on Friday. Higher wages and other costs were likely to turn the past year's net surplus of £3·9 million into a deficit, the EEB chairman, Mr H. V. Pugh, had advised.

Among equipment to be supplied by EEB to the Eastern Gas Board is a thermostatically controlled heating system to prevent the water seals of gasholders at Brightlingsea from freezing in winter. Mr Therm has not commented.

More Amalgamations Coming?

FURTHER amalgamation of television set and component manufacturers is envisaged by Mr Jules Thorn, chairman of Thorn Electrical Industries. But he has rejected a rumour that an American takeover bid is likely for his company. Sylvania Electrical Products, of the USA, hold about one-sixth of Thorn's Ordinary shares and is the largest single holder, "but there is no question of their making any approach to us—they are more interested in expanding in Germany and Italy," he stated. It has been suggested that British firms want to reduce the virtual domination of the industry by the Philips group and its subsidiary, Mullard, and one method in this direction would be to acquire British set manufacturers. Certainly, with sales still comparatively small competition is getting even fiercer among the firms, and this week Pye launched a "free loan" scheme and on Monday next GEC are spending some £25,000 on advertising a "free view" week.

Contractors fighting new cut-price practice

CERTAIN electrical manufacturers and wholesalers are soliciting orders for equipment at virtually net prices, which do not leave proper allowance for the electrical contractor who has subsequently to install the material. This increasing tendency was referred to by Mr C. J. Veness, vice-president of the Electrical Contractors' Association, at the annual dinner of the Cornwall branch of the ECA recently. The Association and its members were determined to fight the practice and he warned the manufacturers and wholesalers concerned that "they would be on the losing end of the stick."

The practice is most prevalent in lighting installations, it seems, and amongst its protagonists are two or three prominent manufacturers.

The subject of apprentices in the contracting industry was also referred to at the dinner by Mr K. Farnell, principal of the Cornwall Technical College. He thought electrical contractors in the county would be hard pressed to attract the right type of lad in competition with larger installations, but if the contractors banded together the college staff would like to co-operate in the matter. Some firms might be small and not consider it necessary to take on a boy, but unless they did so there would be a dearth of trained men.

Larger Bankside

THE second stage of Bankside power station may have a second generating set. Originally planned for one 120 MW machine, provision is now likely to be made for inclusion of a second but smaller set. Construction of the superstructure has begun.

INSPECTION COUNCIL PROGRESS

THERE are now 15 inspecting engineers operating under the NICEIC, says the Council's Progress Report for the three months ending 30 Sept. One additional engineer was appointed from the beginning of the present month, operating in the South of Scotland and northern parts of Northumberland and Cumberland. The progress report (something separate from the report presented to the annual meeting, see page 775) notes good progress with recruiting.

In the three months covered 83 applications for enrolment were approved by the National Inspection board, 11 applications were rejected and 88 deferred for further inspection. 37 firms were removed from the roll and 57 new applications for enrolment were received.

As a result of representations by the Scottish committee of the NIC, the Secretary of State for Scotland has indicated to local authorities that the number of socket-outlets recommended in the Scottish Housing Handbook is below the reasonable minimum standard.

During the first six months of the financial year 1960-61 167 applications for enrolment as approved contractors were received, as compared with 101, 98 and 128 in the corresponding period of the three previous years. Number of applications during the first nine months of the calendar year 1960 exceeded that for any previous complete calendar month.

In the technical section of the report, the hope is expressed that the extra inspecting engineer will permit a shorter time interval between routine inspections. In some areas, the gap between inspections has been tending towards 18 months recently.

Work has continued on earth fault loop testing instruments, and has indicated that the lighter current types of instruments, injecting perhaps only 5 amp into the loop, give sufficiently accurate information (±5%) for proper testing of the smaller type installation, and always for testing socket outlets.

Experience has confirmed the importance of loop tests.

OFFICIAL PUBLICATIONS

Machine Tool Industry. Report of Machine Tool Advisory Council Sub-committee. HMSO. 2s (see page 748).

A National Fuel and Power Policy. Statement by Association of Scientific Workers. 1s (see page 778).

BS 1442. Galvanised Mild Steel Wire for Armouring Cables. 4s.

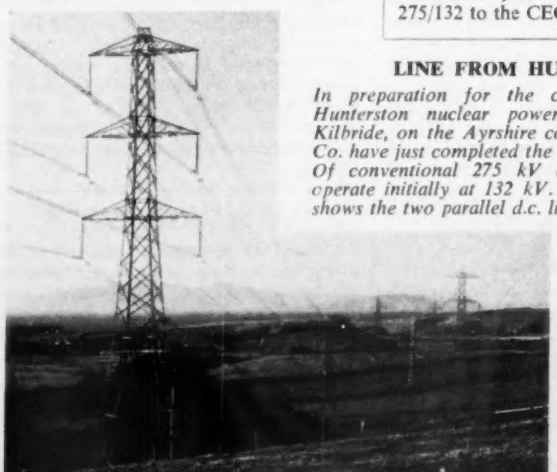
BS Amendment Slips:

562, Reversible connectors for portable appliances for circuits up to 250 volts. Amendment No. 1, PD 3921; 822, Part 2, Terminal markings for d.c. traction motors and control equipment. Amendment No. 1, PD 3931; 1671, Domestic electric kettles, PD 3941; 1991, Part 1, Letter symbols, signs and abbreviations, PD 3920.

LARGE TRANSFORMERS

THE AEI Transformer Division is to build two 340 MVA generator transformers, value approximately £400,000, for West Thurrock power station. They are said to be the largest generator transformers so far scheduled by the CEGB. Voltage ratio at no-load is to be 18·5/300 kV, delta/star connected. Tappings catering for voltage variations of ±10% in 18 equal steps will be provided at the neutral end of the h.v. winding. What is claimed to be the largest transformer ever delivered to the CEGB has been supplied from the Hollinwood works of Ferranti Ltd. It is a 225 MVA, three-phase, 16/295 kV generator transformer for Willington "B" power station. Prior to dispatch, the transformer, which is oil-forced, water-cooled and equipped with resistor type on-load tapping changing gear, was subjected to rigorous tests, including impulse (at 1,050 kV full wave and 1,200 chopped wave) and full-load temperature rise tests.

Hackbridge and Hewittic Electric Co. Ltd. have just delivered a 180 MVA 275/132 to the CEGB.



LINE FROM HUNTERSTON

In preparation for the commissioning of the Hunterston nuclear power station, near West Kilbride, on the Ayrshire coast, BIC Construction Co. have just completed the overhead line contract. Of conventional 275 kV design, the lines will operate initially at 132 kV. Our picture alongside shows the two parallel d.c. lines out of Hunterston, which run some eight miles to a point just north of Dalry, where they form a junction with an existing line from Greenock and Saltcoats. From that junction, one d.c. line continues a further 72½ miles to Neilston substation

New Cooker Factory

RADIATION LTD. are now ready to build their new Scottish factory at Peterhead for the production of water heaters and electric cookers, Mr R. W. Byford, general manager of the company, told members of the local Professional and Business Club last week. All the legal formalities have been completed. Initially, about 50 people will be employed, but allowance had been made for extension at the factory, he said. Mr J. Muirhead, one of the company's senior service engineers in Edinburgh, is to manage the new factory.

£768 damages against L.E.B.

DAMAGES totalling £768 were awarded to an electrical fitter against the London Electricity Board in a High Court action last week. The fitter, Mr A. E. Bird, claimed damages for injuries he suffered through touching a live 6·6 kV busbar at a Hackney substation. The Board admitted liability but contested the amount of damages.

The Board had paid £1,600 into court and, by consent, the judge ordered Mr Bird to have costs of the action up to the date of the Board's first payment, the Board to have costs after 14 July.

The accident occurred on 22 Jan., 1958, when Bird was detailed to clean some switchgear at the substation. The gear should have been rendered safe, but by some mistake one of the busbars was live, it was stated. Bird touched it and was badly burned.

Resuming his job four months later he had an emotional breakdown as a result of going back to the same substation, it was alleged, and, after pyschiatric treatment, left the Board's employment.

But the judge thought Bird had acted unreasonably in refusing the Board's offer of a job where he would have nothing to do with live electricity; and unreasonable in refusing treatment at a rehabilitation centre. If he had accepted those offers, his recovery would have been more rapid, and the judge held that that affected the length of period for which he could recover damages.

APPROVALS FOR GLEN NEVIS

WHATEVER action other organisations may plan, Fort William Town Council last week decided not to oppose the Glen Nevis hydro-electric scheme of the North of Scotland Hydro-Electric Board (to which we referred on 13 Oct.).

Inverness County Council Planning Committee have also agreed to approve the scheme in principle but to lodge a formal protest and to send to the Secretary of State for Scotland a report by the county planning officer which includes suggestions to ensure that the scenic beauty and tourist amenity of Glen Nevis remains unimpaired.

EXTENSION FOR E.D.A. TESTING HOUSE

WORK has just started on extensions to the testing house of EDA in Cleeve Rd, Leatherhead, where much of the testing of appliances will be carried out for the British Electrical Approvals Board. The extensions will include the addition of a second storey over the laboratory wing (which was always envisaged as the first major extension). In addition, improved photographic and X-ray accommodation will be provided at the end of the wing and the office space rearranged to suit the increased amount of work likely to be undertaken in the future. The building work is being carried out by J. Longley and Co. Ltd., the architects being Bucknell and Ellis.

NORMAN COLLINS AT ELECTRICAL CLUB

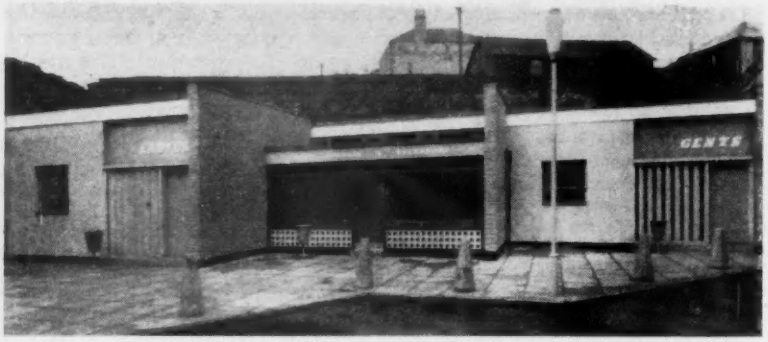
MR NORMAN COLLINS, author of "London Belongs to Me" and deputy chairman of ATV, will be guest speaker at the Electrical Industries Club's Christmas luncheon on 13 Dec. At the November luncheon last week, Col B. H. Leeson, president of the Club, made a welcome return after his accident earlier this year. Col Leeson took the chair and Mr Bernard Braine, M.P., told the "Westminster Story."

BOARDS' APPLIANCE SALES

SALES of electric cookers were the bright spot of appliance sales by the electricity boards in England and Wales during September. The total of 30,563 shown in our table below, is the best monthly figure since March last. For all other major appliances, apart from storage water heaters, the decline continues, although sales of washing machines, at 9,422 were the highest since April. Nevertheless, these totals are considerably down on a year ago, the biggest drop being in respect of refrigerators—over 40%. When assessing these figures it must be remembered that the sales by area boards represent only a part of the total sales throughout the country.

Appliance Sales by Area Boards	Sales in month ended 30 Sept., 1960		Sales in 12 months ended 30 Sept., 1960	
	Total	% change over corresponding period of 1959	Total	% change over previous 12 months
Cookers ...	30,563	+ 2·6	339,908	+ 1·3
Water Heaters:				
Immersion	15,276	−12·5	188,369	− 1·1
Storage ...	5,733	+11·4	68,156	+16·0
Washboilers	5,000	−23·5	58,346	−19·1
Washing Machines ...	9,422	−41·6	127,079	−25·0
Refrigerators	8,124	−40·6	141,241	−14·2

ELECTRICITY AT YOUR CONVENIENCE



ELECTRIC heating, water heating and shaver sockets are among the up-to-date facilities provided in a modern public convenience and left-luggage office built by Stirling Town Council, which was opened a few days ago. Mr W. Cruickshank, the burgh's sanitary inspector and inspector of cleansing, claims that the cloakroom sets a new standard in design and comfort, providing the type of accommodation expected only in first-class hotels.

Erected on a central site in Dumbarton Rd, the building incorporates fully automatic electric floor-warming throughout, together with a constant supply of hot water from electric water heaters. In the gents' toilet there are also sockets for electric shavers, access to which is gained through a coin-operated turnstile. Incidentally, the plumbing is concealed in inaccessible ducts, reducing any liability for damage due to vandalism.

Tastefully finished throughout, the building is constructed in easy-to-clean materials which should withstand hard wear. Electrical contractors were Rigby-Millar (Electrics) Ltd.; the space and water heating systems were installed by the SSEB, and lighting fittings supplied by Atlas Lighting Ltd.

FUEL & POWER POLICY PROPOSED

SUGGESTIONS for a national fuel and power policy are made in a policy statement issued last week by the Association of Scientific Workers. Included amongst the ideas advanced is the basing of electricity generation on coal and back-pressure generation by industry, with oil used only where "the geographical situation warrants it," and no more Calder Hall type power stations.

The Association argue that the number of nuclear power stations to be constructed should be kept down to what is required to obtain experience of various types of reactor. They strongly support back-pressure generation, accusing the electricity supply industry of having a bad record of discouraging manufacturing industry's use of this technique by prohibitive financial terms. The Association wants an annual report published on the number of proposals made for back-pressure generation in parallel with the mains. They also say that area boards should do more to encourage off-peak consumption and to improve load factor in other ways. The demand charge for the bulk supply tariff should be increased; it might incorporate a "small tax element" with benefits to the country as a whole.

The Electricity Council is thought to be the wrong centre for responsibility for research in the supply industry. CEGB activities in the research field are commended.

The conclusion to the policy statement underlines the Association's belief in a continuing importance of coal. One of the suggestions is that the mining industry should be able to be given a guaranteed tonnage market of fixed periods aimed to restrict fluctuations from any one year to the next of ±5 million tons.

Electronics Show grows up

THE bi-annual Radio and Electronic Component Show is to be held at Olympia next year for the first time. The exhibition has grown too big for Grosvenor House and will in future alternate at Olympia with the Instruments and Electronics Show. The next exhibition, from 30 May to 2 June, will be by far the most comprehensive so far, with components for nuclear engineering.

R.P.M. ANSWERS

ALMOST 2,000 replies to questionnaires about resale price maintenance practice reached the Board of Trade as a result of its recent inquiry to traders. Stating this in the House of Commons last week, the President of the BoT said it would only be possible to take account of the replies received up to 7 Oct. He agreed with the questioner that the large number of replies received indicated how numerous were the trades affected and reflected the complexity of RPM questions.

MACHINE TOOLS & ELECTRONICS

ABOUT a year ago the Machine Tool Advisory Council met to consider the report which Prof Seymour Melman, of Columbia University, had prepared for the European Productivity Agency on the state of the machine tool industry in Western Europe. The basis of the report, not published, was to review the condition of the industry to meet competition from mass-produced machine tools from the Russian-dominated countries. Conclusions reached are critical of present methods of production both in Britain and Western Europe.

In "The Machine Tool Industry" the responding report of the sub-committee appointed by the Council which has just been published, Prof Melman's recommendations and criticisms are not accepted without reserve, but it is conceded that there is no cause for complacency. In so far as mass production is concerned, the point is made that Russian mass production is confined to a relatively few types of machine tool and price comparison is not so much in their favour as workmanship is against it. There is some justification in the criticisms that too large a proportion of UK machine tools are made under licence from foreign designs, but the industry has its answer for this. The report refers to the inadequate number of engineers and graduates employed on research and development. In 1958, out of 30,000 employed in some 90 firms only 25 were graduate engineers. More money and effort must be applied to training in universities and technical colleges and to research and development generally.

On the subject of electronic controls, the committee is impressed with the work which has already been done by a few specialist firms. The scope and application is as yet limited to co-ordinate positioning and contour milling. There are other fields in which electronics can be applied, but hesitation is noticeable in using the more complex forms. This may be due to the high price of such equipment and lack of belief in their future, but in a competitive market expansion of this side of the industry is imperative.

N. Scottish Board awards contract

MITCHELL Engineering Co., of Peterborough, have been awarded the contract for the construction of a dam at Loch Nant, Argyll, for the N. of Scotland H.E. Board. The dam, 1,150 ft long and 80 ft high, will be in the Nant section, the smallest of three in the £24·5 million Loch Awe hydro-electric scheme, due to begin production in 1962. The other sections are Cruachan, which is to incorporate the first pumped-storage scheme in Scotland, and Inverawe.

NEW STYLE HOUSES FOR CUMBERNAULD

SPLIT-LEVEL type of house construction is being adopted by Cumbernauld New Town in new buildings soon to be constructed. This construction will take advantage of the sloping ground in the area (with gradients up to 1 in 7 in places) providing living rooms in the upstairs storey and bedrooms below, with floor-warming through the middle supplying warmth upstairs and a bonus of deflected heat below. The first plans incorporating these features have been approved by the Secretary of State for Scotland, and others are soon to be submitted by Cumbernauld Development Corporation.

Work is soon to commence on the first 370 houses in the Seafar precinct, and a further 250 of an improved design have been approved by the Corporation for erection at Ravenswood.

McFadzean names Export Council

BIG guns have been selected for the Export Council of Europe. Membership includes Sir Denis Rickett for the Treasury, Sir Patrick Reilly for the Foreign Office and Sir James Hutchinson, who is president of the Association of British Chambers of Commerce. Members from the electrical industry include Sir Joseph Lockwood, chairman of EMI, and Mr A. M. Browne, chairman and managing director of Hackbridge and Hewittic. As we reported on 27 Oct., Sir William McFadzean has responded to a Board of Trade request to set up the new organisation and be chairman. Primary object of the Council is to "support, stimulate and initiate" action to bring export opportunities in Europe to the notice of British firms.

AMERICAN POWER CONFERENCE DATES

SPECIAL sessions on power and fuels are to be features of the 23rd annual American Power Conference to be held in Chicago from 21-23 March 1961. Also planned are sessions on operation of supercritical power station plants and on new developments in the field of nuclear power generation. Further information about the conference, which is sponsored by Illinois Institute of Technology, is obtainable from the Institute at 35 West 33rd St, Technology Center, Chicago 16, Illinois, USA.

PRIZE FOR SIGN

ANYONE may enter a design competition being sponsored by the Electrical Sign Manufacturers' Association and carrying £335 in cash prizes. The contest is to draw an electrical sign for the façade of a ladies' fashion shop pictured on the entry form. First prize is £150 and entries close on 31 Jan.

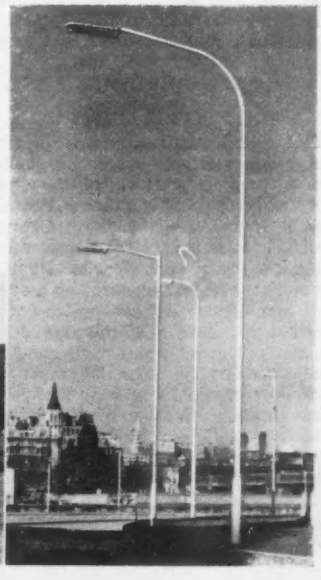
Romania to sell Motors Here

UP to £100,000 worth of electric motors will be imported from Romania between now and 30 Sept. under the terms of a three-year trade agreement signed last week. The quota covers motors from 1 kW to 500 kW capacity. Except for £100,000 of oil drilling equipment and £20,000 of machine tools, the motors are the only engineering goods included in a £3¼ million ceiling for import licences in the first year agreed to by the UK.

Britain may export up to £4¼ million worth of goods to Romania in the coming 12 months, including £2 million of plant and machinery, £50,000 of radar and radio equipment and £50,000 of electric cables. A financial agreement was also signed under which Romania will pay £1¼ million in full settlement of UK war and expropriation claims.

PERMANENT EXHIBITION ON SOUTH BANK

Seventeen street lighting columns and lanterns are among the exhibits at the permanent Street Furniture Exhibition on London's South Bank, opened recently by the Council of Industrial Design. The display, which will be kept up to date, is unattended but free catalogues are obtainable from the CoID or the Design Centre. Daylight appearance is the main concern, so the columns are not illuminated at night. Our pictures show columns for A (right) and B (below) class roads



S. Wales board share costs with farmers

FARMERS in remote areas of South Wales will in future have to pay only half the cost of bringing electricity to their doors. S Wales EB will allow 50% of the total cost of rural schemes, or half the cost of overhead line in excess of 440 yd where only one farm or a few premises can be connected from a not too distant line. Hitherto an allowance has only been made when the new line was to be used for additional consumers during subsequent development. The Consultative Council, which for some months had been pressing for easier terms in remote areas as a prerequisite to a speedier programme, endorsed the Board's proposals at a meeting in Cardiff last week. The Board now expect to complete electrification of all but the most isolated areas by 1965, which the Consultative Council regard as a satisfactory advance on the original plan of 85% rural electrification by 1968. Breconshire, Glamorganshire, Monmouthshire and Radnorshire will be fully electrified by 1963 and Carmarthenshire, Pembrokeshire and South Cardiganshire by March, 1965.

During 1960-61, out of a capital allocation of £6,300,000, S Wales EB will spend £3,200,000 on improving networks and £2,600,000 on new supplies. Included in the total is £850,000 for rural electrification, which the Board envisage will enable them to connect their annual target of 1,500 farms. Part of the sum for improving existing supplies will be used to complete the changeover to alternating current of the remaining 985 direct current supplies in Cardiff and Newport. The Board will also carry on with the stepping up to 240 V of the 20,000 outstanding 200 V supplies in Cardiff and Newport, due to be converted within two or three years.

INDUSTRIAL DESIGN ADVICE

ALL large purchasing organisations should seek the help of the Council of Industrial Design, urged Mr R. Maudling, President of the BoT, in the House of Commons last week. However, he was not able to tell the House what would be the amount of Government grant made to the Council next year.

Simpler names for refrigerants

SIMPLER identification of refrigerants for compressor refrigerators is likely to be adopted as a result of a proposal by the British Refrigeration Association to the International Standards Organisation. At a meeting in Paris recently, a working party of delegates from six countries reached agreement on a system of simplified symbols which would obviate the danger of mistakes due to a multiplicity of brand names and misunderstanding in other languages. ISO will now be asked to publish the symbols for comment, with a view to having them adopted throughout the world. UK manufacturers are likely to adopt the system forthwith. Dichlorodifluoromethane (CCl_2F_2), for example, would be known as R12, and Monochlorodifluoromethane ($CHClF_2$) as R22.

More plant for Douglas

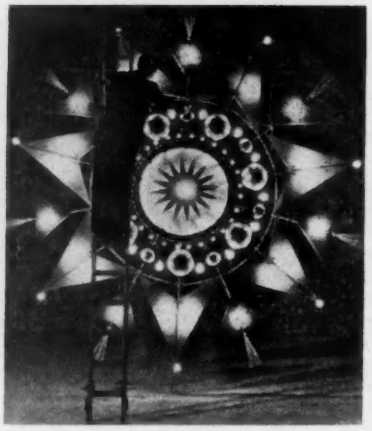
TO enable a 2,200 kW diesel generator to be installed at Pulrose power station, Douglas Corporation are seeking to borrow £76,500. In the application to the Local Government Board, Mr C. Anderson, borough electrical engineer and manager, in referring to the growth of load, pointed out that the Corporation could do with two generators, but were economising by asking for only one.

He estimated that by the time the new set could be installed—March, 1962—maximum demand would have reached 11,370 kW. The last remaining l.p. boiler and turbine at the station would be 24 years old and most unreliable and uneconomical to operate. If the demand increased as expected, it would be necessary to place orders for still further generating plants before the summer of 1962.

Lightmongers at the Livery Hall

SIR ALLEN BROWN, C.B.E., Deputy High Commissioner for Australia, responded on behalf of the guests at the annual dinner of the Lightmongers, held on 8 Nov. in the Livery Hall of the Guildhall. The toast was proposed by Mr T. Catten, social secretary. The president, Mr V. G. E. Gardner, commented on the growth of the Lightmongers from their original meeting of 11 in 1953. He then introduced the succeeding president, Mr R. V. Stevens. This year the cheque for charity was presented to the EIBA.

Jingle Bells!



Testing one of the illuminated medallions in readiness for erection in Regent St, London. Measuring 12 ft to 15 ft these medallions, with angels over 10 ft tall, form the main features of the Christmas illuminations to be switched on next Monday. The set pieces are made by W. S. Chrysalline Ltd.

G.E.C. helps the blind

A BIG advance has been made in printing braille. After years of research, the Royal National Institute for the Blind has perfected a method of printing with plastic dots instead of dots embossed in the paper. One of the problems was that the plastic ink has a gelling temperature near the flashpoint of the paper. In consultation with General Electric Co. this was solved by using infra-red sheathed wire heating panels to heat the paper evenly. Thinner paper can be used than for the embossed method, and the dots are not crushable.

GT. YARMOUTH TO STOP SUPPLYING COOKERS?

A RECOMMENDATION by the housing manager, Mr J. E. C. Lamb, that Great Yarmouth Corporation should stop providing cookers and washboilers in Council houses is to be further considered by the Housing Committee next week. If the responsibility to provide these items were transferred to tenants, Mr Lamb estimates that the Corporation would save £9,065 a year, which would otherwise have to be spent on replacing the equipment, plus £2,000 on repairs. He proposed that existing cookers and washboilers over seven years old in Council houses should be disposed of by giving them to the tenants and those under seven years old by selling them to tenants, either for cash or on deferred terms. He estimates that sale of the older equipment could produce between £10,000 and £12,000. Mr Lamb suggested freedom of choice in future.

The Housing Committee have studied the scheme, but postponed the matter till next month for further consideration. Mr Lamb is thinking of the Corporation's future outlay. He has pointed out the anomaly between pre-war and post-war properties. In the former, tenants had to provide their own equipment, whereas in post-war houses they were installed by the Council. Equipment installed in early post-war developments was becoming obsolete and, once the Council started replacing them in the 3,375 dwellings it had built since 1947, it would be committed to a heavy capital outlay for a number of years.

More Scottish industries?

A PARTY of British industrialists, at the invitation of the North of Scotland Hydro-Electric Board, undertook a three-day fact-finding tour of N. Scotland last week with a view to the possibility of setting up new industries in the area. Among the party were Mr R. S. Bannister (English Electric Co. Ltd.), Mr J. A. Aked (A. Reyrolle and Co. Ltd.) and Mr H. S. A. Ross Dilson (Partridge Wilson and Co. Ltd.).

SUPPLY INDUSTRY INVESTMENT

INVESTMENT needs and investment policy of the nationalised electricity supply industry received attention from many MP's during the House of Commons debate last week on the recent White Paper on public investment (ELECTRICAL TIMES, 10 November). The debate was opened by the Chancellor of the Exchequer who noted the continued ten-year doubling of demand for electricity.

On the question of varying the level of investment in nationalised industries as a weapon for controlling the economy, the Chancellor warned that unless reasonably firm plans were made well in advance it was impossible to get full value for money. Therefore, there was a large proportion of nationalised industry investment which could not sensibly be varied within the time scale that would be useful from a broad economy point of view. It also had to be remembered that the nationalised industries had end-products basic to the national economy. That implied that it was dangerous to restrict their expansion too much.

On the whole, the Chancellor thought the industries should earn a return which would cover depreciation, obsolescence and interest and still leave something over with which to build up reserves.

Sir Toby Low, who is chairman of the Select Committee on Nationalised Industries, suggested that the Government should concern themselves only with what a nationalised industry was borrowing, not with how much it could invest as a result of the surpluses it earned. Noting that the Select Committee on Nationalised Industries was likely to make a report on each nationalised industry about once every seven years, he suggested it might have a "short and quick inquiry" immediately after an investment White Paper such as that recently issued.

Mr G. Nabarro spoke at length on electricity supply, and wanted investment control by an annual bill, limiting the lending of each industry for the year ahead. Mr R. Gresham Cooke thought that at least half the capital investment of the electricity industry ought to come out of the industry's own reserves. He thought it wrong to charge (as he alleged) a unit price which was the same all over the country. Another MP, Mr N. Ridley, argued that hydro-electric plans in the Scottish Highlands should be cut heavily.

Replying to the debate, the Minister of Power, Mr R. Wood, said that the question of differential tariffs should be left to the commercial judgment of electricity boards. On investment generally, he reiterated the official opinion that it was only possible to cut or expand investment in short-term programmes. Unfortunately, merely because a project was short term it was not necessarily less urgent or important than a long-term programme. Later, the Chancellor of the Exchequer expressed himself as having an open mind on the idea that investment plans should be considered by the Select Committee for Nationalised Industries immediately after publication.

Ulster's search for nuclear station site

PRESENTING a supplementary estimate of £11,000 to defray the cost of investigations for a nuclear power station site, Lord Glentoran, Northern Ireland Minister of Commerce, said no statement could yet be made about the location of Ulster's nuclear power station, except that it would be in a coastal area. They were looking for a site for use at a time when they might decide that generation by nuclear power would be an economic development.

The Minister added that he would be reporting to Parliament about the conclusions reached regarding the future form of electricity development when it was decided what was the best course to adopt.

The £11,000 supplementary vote asked for (and subsequently approved) was required to pay contractors and consulting engineers. Lord Glentoran added that money had already been spent on investigations in the Lough Neagh area, but although a suitable site had been found there, it was ruled out for public health and safety reasons, although many advantages could be claimed for that site.

Now the N. Ireland Government is considering other locations.

At the dinner-dance of the ASEE Golfing Society, which concluded a most successful season, the captain, Mr E. C. Green, announced that £100 had been collected for the EIBA. Our photograph below shows, left to right, Lady Eccles, Sir Josiah Eccles, Mrs E. C. Green, Mr E. C. Green, Mrs Maddox and Mr Maddox, at the function

Supply Union's Plan

THE unions' plan to thwart the trouble-making unofficial shop stewards' committee in the Electricity Supply Industry was approved by leaders of the five unions on Monday. They now propose to have early negotiations with the Electricity Council with the aim of amending procedure mainly at local level. The idea is to have regular local meetings between the men's representatives from works committees and the union officials who sit on the district joint industrial councils.

It is hoped that this change will eradicate any tendency to form unofficial groups among the members.

There is a further suggestion of alteration of the constitution of the NJIC to permit district officials to attend local meetings at power stations and depots, a change which would require approval of the signatories of the Agreement.

Civil Service Scientists

ALLEGATIONS that half the vacancies in the Senior Scientific Officer grade of the Civil Service were not being filled because of recruiting difficulties, and also 80% of vacancies in the Scientific Officer grade, were made by Capt D. Ginsburg, MP for Dewsbury, in a House of Commons question to the Prime Minister last week. The Prime Minister in reply pointed to the excess of demand over supply where scientists were concerned, but admitted that salaries might be inadequate in the Scientific Civil Service. The matter was being studied by the Pay Research Unit, which was about to make a report. However, extra pay would not increase the overall number of scientists available to industry and the Government.

Tyne 275 kV line

JARROW Council are still objecting to the proposed 275 kV line route across the Tyne. They want the line placed underground where it will pass through the borough. The power line, between Blyth and Tees-side, is planned to pass through the eastern part of Jarrow into South Shields and beyond.

Long negotiations were followed by a public inquiry, since when Jarrow has suggested a further route to the four already put forward. Last week the County Planning Officer, in a letter to Jarrow Housing Committee, invited the latter to withdraw their objection requiring the line to be placed underground. The Committee decided otherwise.

Wholesalers to move

ELECTRICAL wholesalers since 1924, W. L. Turner, of Victoria St, S.W.1, have now become a limited company. The change presages the semi-retirement of Mr W. L. Turner, joint founder (with his father) of the firm, and the business is to transfer to larger premises in Rochester Row early in the new year.

COMPUTER FILM

A FAST-WORKING data processing computer is the subject of a publicity film entitled "The AEI 1010 in Industry." The 1010 (its title is the binary equivalent of 10), is a digital computer which, working in conjunction with peripheral equipment, is capable of taking over the whole of the "paperwork" associated with production, accounting and sales of the largest manufacturing concerns. Peripheral equipment consists of magnetic storage drums, card and tape punching machines, line printers and other devices whose function is to enable information to be fed into the computer and stored, the required results being tabulated. The particular feature of the 1010 is that its speed of working, 70,000 operations per second, is many times that of the peripheral machines. This enables it to handle several programmes, in effect simultaneously, by dividing the relatively large computing time made available. Once installed, the computer can be set to work with the minimum amount of equipment to handle initially, say, the wages of a particular company. Its range can then be gradually extended.

Retail Sales Steady

THE retail picture remained much the same in October as in September, with durable goods sales again well below the level of a year earlier and sales of clothing and footwear buoyant. Allowing for a 1% rise in prices, overall sales were about 3% higher in volume than a year ago.

150th ANNIVERSARY

IN celebration of their 150th anniversary, C. F. Casella and Co. Ltd. have published a brochure which, in addition to illustrating a selection of the laboratory and industrial instruments which they manufacture, gives a brief outline of the firm's history and growth.

Sayings OF THE WEEK

"Plenty of socket-outlets provide flexibility without flex." . . . MR C. T. MELLING, at the NICEIC annual luncheon.

"Unless reasonably firm plans are made well in advance, it is impossible to get full value for money. Therefore, there is a large proportion of public investment that cannot be sensibly varied within the time scale which would be relevant." . . . THE CHANCELLOR OF THE EXCHEQUER, speaking about altering nationalised industry investment plans to meet economic difficulties.

"With the right extended training scheme every apprentice would carry a chairman's pen in his tool kit." . . . THE DUKE OF EDINBURGH, at prize presentation of the Gauge and Toolmakers' Association.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, November 15

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	225½	+¾	ZINC, virgin, min. 98% purity (cash)	86½	−2
,, (3 months)	225½	+¾	,, (3 months)	87	—
LEAD, refined pig, 99·97% purity (cash)	68	−1¼	RUBBER, per lb No. 1, RSS, spot	26½d	−¼d
,, (3 months)	69	−¼	c.i.f. basis, ports, Jan. ...	26½d	−¼d
TIN, refined, min. 99·75% purity (settlement)	803	+3	ARMOURING: Galv. Steel Wire (0·104 in.) ...	66½	—
,, (3 months)	799	+1	Mild Steel Tape (0·04 × 1½ in.)	53*	—
ALUMINIUM, ingots 99·99·5% ...	186	—	NICKEL (home)	600	—
,, wire bars (4×4×54")	193½	—	MERCURY (76 lb flask)	70½	—
BRASS Strip 63/37	201	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz)	79½d	—	Lead, (New York)	12c	—

** Tape Price, now an average, includes varnishing*

Traders protest at Honiton Exhibition

ELECTRICAL retailers in Honiton have protested at the exhibition and sales drive of electrical appliances organised in the town by the South Western Electricity Board last week. The Mayor of Honiton, Ald F. W. C. Tucker, refused to open the exhibition because he maintains it is the Board's job to sell electricity, not to compete against private traders. "It should be the duty of electricity boards to plough back any profits made from the supply of electric current to reduce the cost of electricity, not to dabble in financing hire-purchase of electrical appliances," he declared.

Commenting on the Mayor's remarks, Mr F. Richardson, Exeter district manager to the Board, said the object of their trading was to develop the sale of electricity. It was their experience that such exhibitions were of benefit to all electrical traders in the towns where they were held. He also pointed out that in 1956 the Herbert Committee had recommended that retail trading and contracting by electricity boards was in the best interests of consumers, and that the consumer could best be protected by free competition between the boards and private business.

Cost Engineers' Group

A BRITISH group of the American Association of Cost Engineers has been established, with the same objectives as the parent organisation. The group is already able to provide members with a library and reference service, and a series of regular meetings are proposed, the first of which will take place in London on 12 Dec. Chairman of the British group is Mr J. H. Herbert (Kellogg International Corpn), with Mr K. M. Curwen (Allbright and Wilson), as deputy chairman. Other details are obtainable from the secretary, Mr T. B. Woods, 32 Spring Close, Sherborne St. John, Basingstoke.

NEW SUBSIDIARY

DESOUTTER Brothers (Holdings) Ltd. has subscribed 76% of the issued capital of a new subsidiary—Carter Stevens (Automation) Ltd.—to carry on the businesses of Carter Stevens and Co. (Engineering), Carter Stevens and Co. (Automation) and Blakeman Designs, all of Coventry.

News in Brief

By ten votes to nine, Bromsgrove Urban Council has decided to provide a choice of electricity or gas in houses to be built at the Charford estate "as an experiment."

The Electricity (Amendment) Bill, which proposed permission for the CEGB to make and sell radioisotopes, is to be debated in the House of Commons on Monday next.

Arrow Electric Switches Ltd. last week entertained some 200 of their customers and friends at a cocktail party at Queen's Hotel, Birmingham.

Amongst new work recently started by BSI is preparation of a standard on hand-operated a.c. and d.c. switches for aircraft to replace BS G129 and BS G145.

Some 240 members and their guests attended the annual ball of the Ipswich and District Electrical Association at the Royal Hotel, Clacton, on 4 Nov. So popular has this function become that it gets increasingly difficult to find a venue sufficiently large to accommodate all those wishing to attend.

Educational Productions Ltd. have published a wall chart which illustrates an electric kiln and its component parts, together with biscuit and glaze firing. It is priced 1s.

First deliveries of uranium fuel arrived at the new Berkeley nuclear power station last Thursday.

The first major exhibition on atomic energy ever to be held in Wales opened at the Welsh College of Advanced Technology, Cathays Pk, Cardiff, on Monday. Presented by the UKAEA, it continues until 26 Nov.

Benjamin Electric Ltd. held a further two days' conference and course for electrical wholesalers' sales representatives at their Tottenham works on 10-11 Nov.

Company Activities

KENNEDY wins. And the cry is "inflation." That is how the Democrats' victory in the US Presidential election has been widely interpreted. There is, of course, every reason to think that when Mr Kennedy takes over next January there will be vigorous attempts on the part of the US Administration to speed up economic advance. Wall St, at first in two minds about it the day after the polling, decided that new bouts of inflation can be expected—and up rocketed the Dow Jones industrial share index by 11 points from the day's low to finish at 602·25. The same day in London the *Financial Times* industrial ordinary index fell away 3·1 points to 312·5. London, by still refusing to follow the Wall St lead, is perhaps showing greater common sense in its estimate of the post-election implications for the US economy. And that is that more harm than help would be the result for US industry if Kennedy were to give rein to the alleged stimulative forces of inflation. Already embarrassed by its heavy balance of payments deficit, aggravated by the continuing outflow of gold, any fresh round of internal price increases is inevitably going to price US goods out of world markets. Many would say that they are already at that point. And if they become more so that would, of course, lead to a deepening of the mistrust now surrounding the dollar. Therefore, I think we shall find that Mr Kennedy will tread very softly indeed upon the pedals of inflation. Equity prices grow on the facts or the smell of inflation. Wall St last week was away. London at the moment hesitates. And that way there is less likely to be a finger-burning fall-back later on.

Electrical shares, too, last week were for the most part dull. In the heavy brigade, GEC dropped back 6d to 32s 9d, AEI eased 1s 6d to 43s 3d, and English Electric retreated 9d to 32s 9d. Elsewhere, Thorn Electrical were 9d cheaper at 45s and E. K. Cole slipped 1s 3d to 21s 1½d.

The 10s Ordinary shares of the Decca Record Co., however, found their way into the "hit parade" with an against the trend rise of 1s 9d to 50s 4½d. Chairman Mr Lewis gave shareholders a pretty cheerful report at last week's meeting. With seven months of the company's current year gone he has never felt more confident about the company's trade in gramophone records. Transistor radio sales had been much greater than last year although there has been the inevitable drop in TV sales.

On the upturn, too, the £1 Ordinary shares of British Insulated Callender's Cables edged up 1s 3d to 48s 9d, although half-time net profits have come back from £1,791,000 in the six months to 30 June, 1959, to £1,748,000 for this year's first six months. And that is on group sales £11 million higher at £74 million. It indicates that the effects of the now abandoned cable price war are still being felt. But as price war contracts come to be worked off the newly raised prices, under BICC's lead, will then begin to benefit the company's profit and loss account. It is more on expectations, with the group's turnover being maintained in the second half of the year, rather than on actual results that dealers marked up the shares. The interim has been repeated at 4% and chairman says that on the basis of current trading, indications are that the profits for the whole of 1960 should not differ materially from those of last year. That points at least to a maintenance of the twice covered 13½% total dividend and on the basis of which the shares now yield 5½%.

Disappointment of the week was Joseph Lucas (Industries) where, despite the 1½% increase in the dividend to a thrice covered 13¼% and the net profit rise from £2,527,437 to £2,923,424, the £1 Ordinary shares slumped 4s 4½d to 60s.—*From our City Correspondent.*

British Insulated Callender's Cables

The unsatisfactory profit position on both l.v. power cables and wiring and general cables in recent months is reflected in a decline in the trading surplus for the six months to 30 June last. The figure is £4,469,000, compared with £4,806,000 for the corresponding period of 1959, although group sales expanded by £11 million to £74 million. After taxation, etc., net profit for the period is £1,748,000 *(£1,791,000)* and the interim dividend is maintained at 4%. On the basis of current trading, indications are that the profit for the whole of 1960 should not differ materially from that of last year, Sir William McFadzean, the chairman states. He points out that the full effect of the severe price cuts in cables was felt in the first half of this year, and although the company has taken the initiative to lead prices to modest but sensible economic levels, these will not be reflected to any important degree until next year. The many other activities of BICC have continued to make good progress, he adds.

Burgess Products Co. Ltd.

With improved profit figures, dividend for the year to 31 July last is raised 5% to 20%. Group profit is £303,317 *(£99,220)*.

Contactor Switchgear Ltd.

The reduction in profits is due mainly to increased competition and an all round rise in the cost of production, Mr H. Rayner, the chairman, reports. The new factory at Leominster is now in production. Orders have been coming in well, ensuring that both works will be fully occupied in the current year. Last August, the business of Radio Aids Ltd. was purchased and the name has been changed to Contactor Switchgear (Electronics) Ltd. They are in process of being moved from Watford to the Wolverhampton Works.

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	164,307	65,084	57	18	13/4	10/6
1957	201,687	76,698	67	20*	10/6	8/4
1958	222,608	85,016	49	14	13/-	9/-
1959	191,663	78,901	43	14	17/-	12/-
1960	170,130	58,209	32	14	18/6	14/-

* Plus 50% capital bonus.

Dictograph Telephones

For the year to 31 Aug. last, net profit after tax is £183,327 *(£150,327)* and a final dividend of 10% makes the total distribution 20% (against the equivalent of 15% last time).

Engineering and Lighting Equipment Co.

There is to be a one-for-one scrip issue.

Lightfoot Refrigeration

A substantial loss is anticipated for 1960, due principally to trading conditions in the domestic refrigeration market, Mr B. T. Aikman, chairman, states, and no dividend is to be recommended. It has been decided to discontinue this relatively new activity in order to avoid further losses. (The firm handled "Linde" refrigerators made in West Germany.) Contracts in hand for the main business of refrigeration engineering are now a record, and the directors are confident that a sound profit-earning basis will have been re-established by the beginning of the next financial year.

Metal Industries Ltd.

Maintaining an interim dividend of 6% on the larger capital (with the acquisition of the Lancashire Dynamo group and the one-for-four rights issue) the chairman, Sir Charles Westlake, reports a group profit of £1,132,000 for the six months to 2 Oct. last. This compares with £850,000 for the corresponding period of 1959 (prior to LD takeover). The 1960 balance comprises £722,000 profit of the original MI group for 26 weeks and £448,000 of LD for approximately 32 weeks. The group order books are 30% up on the same time last year and inquiries and orders maintain their encouraging levels, Sir Charles adds.

Sun Electrical Co. Ltd.

After charging taxation at £78,210 *(£45,200)*, net profit for the year ended 30 April last increased to £71,922 *(£60,885)*. The final dividend is raised 1% to 13½%, making the total 18½% *(15%)*.

Yarrow and Co. Ltd.

After taxation, the group net profit for the year to 30 June last is £340,434 *(£315,646)*, and dividend is again 17½%.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

17 Nov.—Belfast C.C. Electrical installation in Assembly Hall, Dunkeld Gdns Modern Secondary School for Girls.—See 27 Oct. issue.

17 Nov.—Birmingham C.C. Socket-outlet installations and lighting installation repairs in 250 houses at Acock's Green.—See 20 Oct. issue.

17 Nov.—Darfield U.D.C. Rewiring of 118 houses.—See 3 Nov. issue.

17 Nov.—Edinbargh C.C. Electrical installation in Bristo Technical Institute laboratory. Applications to City Architect, City Chmbrs, by above date.

17 Nov.—Penybont R.D.C. (b) 140 W sodium lighting on 25 ft columns scheme at Llangynwyd.—See 10 Nov. issue.

18 Nov.—Breconshire C.C. Electrical work at County Surveyor's Depot, Beili Bedw, Sunnybridge.—See 10 Nov. issue.

18 Nov.—Gateshead B.C. (a) Electrical installation in four-form entry Greenwell County Secondary School for Girls. Applications to Borough Surveyor, Swinburne St, by above date. Deposit £3, made payable to Borough Treasurer.

18 Nov.—Glasgow C.C. Supply of electrical material for year from 1 Jan. Manager, Housing and Works Dept., 266 George St, Glasgow C.1.

18 Nov.—Hornchurch U.D.C. Class "A" lighting, Trunk Rd A13; (1) resiting of 30 steel units and erection of 34 steel units; (2) supply of 34 steel columns; (3) supply of 83 lanterns; (4) supply of 83 sets control gear; (5) supply of 83 horizontal 400 W MBF/U lamps.—See 3 Nov. issue.

18 Nov.—Maidstone B.C. Electrical installation in conversion of 107 Tonbridge Rd into an old people's hostel.—See 10 Nov. issue.

18 Nov.—N.I. Housing Trust. Plumbing, electrical and patent tile subcontract in 47 dwellings, Kary Hill, Downpatrick.—See 10 Nov. issue.

18 Nov.—Old Fletton U.D.C. Improvement to Group "B" standard of 58 street lighting units.—See 10 Nov. issue.

19 Nov.—Halesowen B.C. Supply and erection of 60 Class "A" and 70 Class "B" street lighting units on concrete or steel columns along various roads.—See 10 Nov. issue.

21 Nov.—Bradford C.C. Electrical installations in 22 flats at Holme Wood Housing site (scheme 61). Engineer and Surveyor, Town Hall. Deposit £2 2s.

21 Nov.—Chertsey U.D.C. Erection of 92 25 ft and 23 15 ft concrete columns plus two steel columns and installation of fluorescent, sodium, mercury and tungsten lighting and for dismantling 64 15 ft columns.—See 10 Nov. issue.

21 Nov.—Diss U.D.C. Supply and installation of street lighting at Mere St, Diss.—See 10 Nov. issue.

21 Nov.—Haverhill U.D.C. Supply of 14 Group "B" 15 ft columns and lanterns suitable for tungsten or 80 W mercury lighting with chokes and control gear.—See 10 Nov. issue.

21 Nov.—Morpeth R.D.C. Electrical installations in 18 houses, Mitford.—See 3 Nov. issue.

21 Nov.—Nuneaton B.C. Erection of 126 columns and wiring; 39 85 W and 35 60 W sodium and 52 100 W tungsten lamps.—See 10 Nov. issue.

21 Nov.—Selby U.D.C. Supply of street lighting equipment: (a) 30 140 W sodium lanterns and auxiliary equipment; (b) 22 pre-stressed spun concrete columns; (c) eight steel columns. Engineer and Surveyor, H. E. Phillips, 12 Pk St.

21 Nov.—Swinton and Pendlebury B.C. Electrical installations in 76 dwellings at Clifton. Borough Engineer and Surveyor, Town Hall.

21 Nov.—Wednesfield U.D.C. Supply, erection and wiring of 17 Group "A" Stanton 8F columns with mercury lighting and three Group "B" mercury equipments on columns to be supplied by U.D.C.—See 10 Nov. issue.

21 Nov.—Wetherby R.D.C. Electrical installation modernisation in (Group 1) 58 houses, Wetherby, and (Group 2) 50 houses at Clifford, Collingham, East Keswick, Torner and Weeton. Housing Manager, Council Offices.

23 Nov.—Durham C.C. (b) Electrical installations in High Coniscliffe new County Junior and Infant School. Applications to County Architect, South St, Durham, by above date.

23 Nov.—East Kesteven R.D.C. Provision of additional power and lighting points included in modernisation schemes involving minor structural alterations, the provision of hot water supplies and other plumbing work in (Contract 1) 72 houses at Ruskington and Anwick; (2) 79 houses at Ashby, Barkney Fen, etc.; (3) 75 houses Billinghay and North Kyme. Architect, Council Offices, Northgate, Sleaford.

24 Nov.—Dublin. Electrical installation in proposed pathological laboratory and mortuary building at Sir Patrick Dun's Hospital.—See 3 Nov. issue.

24 Nov.—Manchester C.C. Electrical installations in 31 houses and four shops, Partington. Contract 330/331. Director of Housing, Town Hall.

24 Nov.—Middlesex C.C. Contract Sub. 39. Wiring, lighting and heating of power house at Deephams Sewage Wks, N.9, by contractors with d.c. experience. Contract includes supply of miscellaneous plant and an automatic telephone exchange.—Advertised 3 Nov. issue.

24 Nov.—Ystradgynlais R.D.C. Supply of 178 sodium lanterns and accessories. Surveyor, Council Offices, Ystradgynlais, Swansea.

25 Nov.—Caernarvon B.C. Supply and erection of 86 25 ft steel columns, complete with 140 W sodium lighting and supply only of 14 wall brackets with 140 W sodium lighting/control gear/time switches.—Advertised 10 Nov. issue.

25 Nov.—Manchester C.C. Electrical installation in Harpurhey Technical High School for Girls.—See 3 Nov. issue.

25 Nov.—Wembley B.C. Provision and erection of 324 sodium and fluorescent Class "A" units and removal of existing columns. Borough Engineer and Surveyor, Town Hall.

25 Nov.—Woodford Green. Applications invited for inclusion in (No. 4) list of approved electrical contractors, Claybury Hospital.—See 10 Nov. issue.

26 Nov.—Alfreton U.D.C. Installation of 134 Atlas 140 W sodium lamps and Stanton concrete columns. Engineer and Surveyor, Council Offices, Nottingham Rd. Deposit £2 2s.

28 Nov.—Aberdeen C.C. Supply of lamps during 1961.—Advertised 3 Nov. issue.

28 Nov.—Lanark C.C. Street lighting equipment for A8, Dewshill: (1) eight 280 W sodium lanterns; (2) 16 leak transformers; (3) 16 capacitors; (4) eight 35 ft columns with 9 ft outreach.—Advertised 10 Nov. issue.

28 Nov.—Lisburn. (a) Electrical installation in Wallace High School extension, Antrim Rd.—See 10 Nov. issue.

28 Nov.—Stockport B.C. Supply of 850 Class "B" concrete street lighting columns. Borough Surveyor, Town Hall.

29 Nov.—Londonderry B.C. Supply of school equipment including: film projector, radio, record player, suds pumps, mobile resistance unit, variable capacitor, wattmeter, galvanometer and oscilloscope. Director of Education, Brook Pk.

30 Nov.—Croydon B.C. Electrical installation in Oval School, Oval Rd. Borough Engineer, Town Hall.

30 Nov.—Edinburgh. Electrical engineering maintenance contract for year to 31 Dec., 1961, in hospitals for Royal Victoria and Associated Hospitals' Board of Management.—See 10 Nov. issue.

30 Nov.—Hampstead B.C. (1) Supply of lanterns and ancillary equipment for colour corrected mercury lighting; (2) supply and erection of Group "A" specified tubular steel columns, installation of equipment in contract 1 for 5¼ miles of Group "A" lighting. The latter contract also includes the removal of existing Group "B" lighting. Borough Engineer and Surveyor, Town Hall, Haverstock Hill, N.W.3. Deposit £2 2s.

30 Nov.—Tottenham B.C. Supply of (Item 3) lamps for year.—See 27 Oct. issue.

1 Dec.—Chesterfield B.C. Supply of: (1) 88 25 ft tubular steel columns and one wall bracket; (2) 71 140 W sodium Group "A" lanterns; (3) 18 3 by 80 W fluorescent lan-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 110 queries answered this week

"Pollyput" polythene electric kettles—suppliers of? G.E.W.—G. and E. Equipment and Contracts Ltd., Gore Rd Wks, New Milton, Hants.

"Jeani" bell pushes—makers of? E.B.—Fitzgibbon and Murray Ltd., Smallfield Wks, Horley, Surrey.

"Lindner" lighting fittings—makers of? T.E.—Loblite Ltd., Third Ave, Team Valley, Gateshead-on-Tyne 11.

"Columbus" time switches—makers of? M.E.—Elkay Electrical Mnfg. Co. Ltd., 42 Woburn Pl, W.C.1.

"Rototherm" thermometers — makers of? L.E.B.—British Rototherm Co. Ltd., Station Rd, Merton Abbey, S.W.19.

"Kaloric" convector heaters—address for? J.D.W.—M. and J. Lossos and Co. Ltd., 31 Beethoven St, W.10.

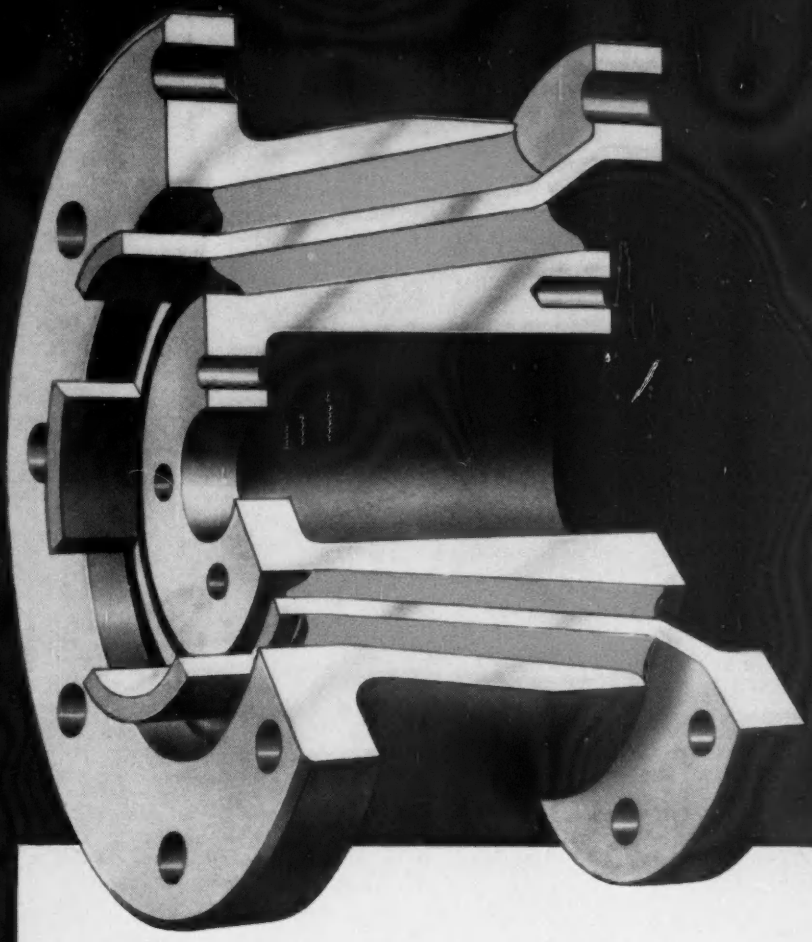
"Whirlpool" washing machines—address for spares? E.D.A. — Home Electric Washer Co. Ltd., 17 Aylmer Parade, Highgate, N.2.

"Beekay" mincing machines—agents for? R.C.S.—The Brattel Electric Co. Ltd., 1 Dover Yard, W.1.

"Alumbro" aluminium-brass alloys—makers of? G.W.B.—Imperial Chemical Industries Ltd., Metals Division, 81 High Holborn, W.C.1.

ANSWER WANTED

"Neta" extractor fans — makers of? M.A.C.—



Double-cone couplings

(PATENTED)

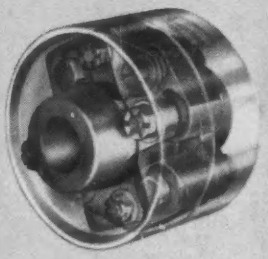
Damp Torsional Vibration, Resist Thrust, Absorb Shock Loads

A high degree of torsional flexibility combined with large torque capacity singles out the Double-Cone Coupling for drives in which torque fluctuations and torsional vibration must be controlled.

The design is suitable for torques up to 100,000 lb. ins. and torsional deflections from 5°-10°. It permits some angular misalignment and is designed to resist end thrust.

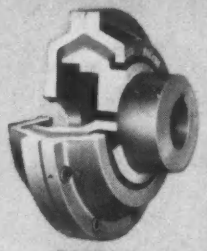
Available in a number of standard sizes, the Double-Cone Coupling is of robust construction and requires no maintenance.

SOME OTHER METALASTIK COUPLINGS



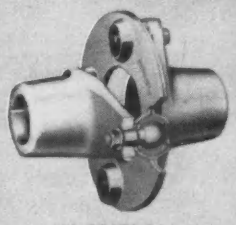
TRAILING LINK

Accommodates exceptional parallel misalignment. In range of sizes to transmit 1-20 h.p. per 100 r.p.m.



BICONE

For marine and other applications, transmits thrust, absorbs torsional vibration and accommodates misalignment. For drives of 5-10 h.p. per 100 r.p.m.



UNIVERSAL

Accommodates a large amount of angular misalignment with very low resistance. In sizes to transmit 0·3–3 h.p. per 100 r.p.m.

METALASTIK

METALASTIK LTD. LEICESTER

Two 300 MW sets for Lakeview, Ontario

From an original drawing supplied by the Hydro Electric Power Commission of Ontario

THIS artist's impression shows the Lakeview Generating Station now being built beside Lake Ontario. With its planned capacity of 1,800 MW, it will be one of the world's largest thermal-electric plants. Two 300 MW turbine-generators have been ordered from AEI and the first will be installed in 1963. These generating sets, like all AEI equipment, will incorporate advanced design based on long experience.

The AEI turbo-generators for Lakeview will have hydrogen-cooled rotors, and the system of water cooling of stator windings first developed by AEI engineers. The four-cylinder single-axis turbines will operate at steam inlet conditions of 2,350 psig and 1,000°F, with reheat steam at 1,000°F.

For further details, write to AEI Turbine-Generator Division, Trafford Park, Manchester 17, or to your local AEI Office

AEI Associated Electrical Industries Ltd.
Turbine-Generator Division

MANCHESTER 17 & RUGBY, ENGLAND · GLASGOW, SCOTLAND · LARNE, NORTHERN IRELAND
B/A 003

terns and 18 400 W coloured corrected mercury lanterns complete with lamps/gear; (4) 71 140 W sodium lamps/jackets/gear for A61 Exeter-Leeds Trunk Rd lighting. Borough Engineer's Office, Town Hall. Deposit £2 2s.—Advertised in this issue.

2 Dec.—Braintree and Bocking U.D.C. (1) Erection of 112 Group "B" prestressed concrete columns; (2) supply, erection and wiring of 115 45/60 W sodium lanterns; (3) laying cable ducts; (4) dismantling existing installation; (5) incidental works.—Advertised 3 Nov. issue.

3 Dec.—Cambridgeshire C.C. Supply, erection, wiring and fitting: (1a) nine 35 ft steel columns with 200 W sodium lighting at Caxton Gibbet roundabout (A45 and A14); (1b) eight 35 ft steel columns with 200 W sodium lamps at Four Went Ways roundabout (A11 and A604); (2) five 25 steel columns with 3 by 80 W fluorescent lamps at Bury Toll junction near Newmarket (A11 and A45).—Advertised 10 Nov. issue.

5 Dec.—Chigwell U.D.C. (i) Supply of (a) 21 steel columns and (b) lanterns/lamps; (ii) erection and installation of 21 200 W sodium units for A11 No. 2 lighting scheme. —See 3 Nov. issue.

5 Dec.—Manchester C.C. Supply and installation of outside lighting of existing aeration plant at Davyhulme Sewage Wks.—Advertised 3 Nov. issue.

5 Dec.—York T.C. Supply and erection of two 1,867 g.p.m. centrifugal pumps and gear for recirculation pumphouse at Naburn Sewage Purification Works. Details of Contract 8 from City Engineer, Surveyor and Planning Officer, C. J. Minter, 7 St. Leonard's Pl.

8 Dec.—Swansea B.C. Supply of one 3 kW d.c. generator. Water Engineer and Manager, The Guildhall.

12 Dec.—Stockport B.C. 2. Electrical installation proposed Welfare Clinic, Longford Rd West, Reddish.—See 3 Nov. issue.

13 Dec.—Kirkcaldy T.C. (b) Electrical work in erection of new hall at Links St.—See 3 Nov. issue.

14 Dec.—Matlock U.D.C. Supply and installation complete of nine sewage pumps at four pumping stations in Darley Vale.—See 6 Oct. issue.

14 Dec.—Waterford C.C. Supply and erection of two 20 g.p.m. pumps and 380 V 3 ph. motors for Kill and Bonmahon water supply scheme. Details from consulting engineers, H. N. Walsh and Partners, 47 Sundays Well, Cork. Deposit £2 2s.

10 Jan.—Dunblane B.C. Supply and erection of seven Group "A" concrete columns/lanterns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

1 Feb.—Oxford T.C. Supply and erection of two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue.

No date stated—Queensferry B.C. Electrical work in erection of public lavatories and surveyor's stores and in alterations in High St flatted houses.—See 10 Nov. issue.

No date stated—North of Scotland H.E.B. 33 kV switchgear for Burghmuir substation, Perth. Chief Electrical and Mechanical Engineer, 16 Rothesay Terr, Edinburgh 3. Deposit £2 2s.—Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

21 Nov.—Greece. 4,000 metre 500 V, 1,000 metre 1 kV and 700 metre 15 kV cable. Office of State Procurements Services, 50 Socrates St, Athens. B.o.T. (ESB/29151/60).*

23 Nov.—Iraq. Ten mile telephone cables. Ministry of Defence, Director of Contracts and Purchases, Baghdad. B.o.T. (ESB/28897/60).*

24 Nov.—Pakistan. (1) 100,000 yd single-core v.i.r. cable; (2) 50,000 yd v.i.r. cable; (3) 100,000 yd twin 14/·0076 cotton covered flexible; (4) 75,000 yd artificial silk insulated flexible. Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/29144/60).*

28 Nov.—America. (1) 50,000 ft 4-core and (2) 10,000 ft of 3-core 16 AWG rubber insulated cable. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Purchase Contract Unit, Bldg 53, Denver Federal Center. B.o.T. (ESB/29152/60).*

29 Nov.—India. One 20 h.p. centrifugal pump. Additional Chief Engineer (Construction), Civil Branch, Kerala State Electricity Board, Post Box 21, Trivandrum 1. B.o.T. (ESB/29375/60).*

30 Nov.—India. Cable p.i.l.c.d.w.a. for Swang Collieries. Purchase Officer, National Coal Development Corpn., 1 Council Hse St, Calcutta 1. B.o.T. (ESB/219180/60).*

39 Nov.—Pakistan. L.T. cables and wires. Director, Directorate of Supply, P.I.D.C. Hse, Motijheel, Dacca 2. B.o.T. (ESB/29194/60).*

2 Dec.—India. One 150 h.p., 3·3 kV motor and one 3·3 kV o.c.b. National Coal Development Corpn., Chief Purchase and Stores Officer, Darbhanga Hse, Ranchi. B.o.T. (ESB/29185/60).*

5 Dec.—Argentina. One electronic computer for bank duty. Gerencia de Administracion, Banco de la Provincia de Buenos Aires, San Martin 137, Buenos Aires. B.o.T. (ESB/29384/60).*

12 Dec.—New Zealand. Cables and flexibles (13 items). Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/28865/60).*

13 Dec.—Thailand. 100,000 lb all-aluminium conductor; 3 million ft seven-strand all-aluminium polyethylene-covered conductor and tie wire. Metropolitan Electricity Authority, Chakraphet Rd, Bangkok. B.o.T. (ESB/28861/60/DLF).*

15 Dec.—America. Control switchboards, motor generators, etc., for Greers Ferry Powerhouse. Little Rock District Corps of Engineers. B.o.T. (ESB/28180/60).*

15 Dec.—Egypt. Three 750 kW rectifiers, accessories, transformers, switchgear, etc. General Manager, Alexandria Region Public Transport Admin., 21 Midan Saad Zaghloul, Alexandria. B.o.T. (ESB/29122/60).*

16 Dec.—Thailand. 5,000 telephones. Telephone Organisation of Thailand, Ploenchit Rd, Bangkok. B.o.T. (ESB/29170/60).*

7 Jan.—Burma. Six three-ton portal cranes for Rangoon Port. Details, fee £8, from Sir Alexander Gibb and Ptnrs, Queen Anne's Lodge, S.W.1. B.o.T. (ESB/28599/60).*

12 Jan.—Uruguay. 25 main line diesel-electric locos and 14 diesel-electric shunting locos. La Seccion Licitaciones de la Gerencia General de la Administracion de Ferrocarriles del Estado, Montevideo. B.o.T. (ESB/28536/60).*

13 Jan.—India. Cooling towers for Chandrapura. Tender S.E.279. Details from India Store Dept., Government Bldg, Bromyard Ave, W.3. B.o.T. (ESB/28875/60/DLF).*

18 Jan.—Thailand. 16 230/69-12 kV autotransformers and two 13·2 kV, 5,000 kVA shunt reactors. Director-General, Royal Irrigation Dept., Bangkok. B.o.T. (ESB/28198/60).*

27 Jan.—Malaya. Two 150 klb/hr boilers and auxiliary plant for Johore Bahru Power Station, Contract E.E. 1737/2. Crown Agents for Overseas Governments and Administrations, 4 Millbank, S.W.1. Documents fee £15.

31 Jan.—New Zealand. One 30 MVA 66/11 kV transformer. Secretary, Tenders Committee, N.Z. Electricity Dept., Wellington. B.o.T. (ESB/29192/60).*

24 Feb.—Australia. 60 MW turbo-generator and auxiliary plant for Tennyson Power Station. Chief Engineer and Manager, Dept. of Electricity, Kelvin Hse, Adelaide St, Brisbane. B.o.T. (ESB/28852/60).*

No date stated—Sudan. Consortium, including electrical engineers, required to build cotton gin factories. Details from Sudan Gezira Board Representative (U.K.), Castle Chmbrs, Castle St, Liverpool 2. Specification deposit £205 2s 7d.

CONTRACTS PLACED

Durham C.C. Electrical work in schools: Birtley Ravensworth Terr County, T. Mitchelson (Electrical) Ltd., £1,104; Billingham Campus School, C. Horne and Co. Ltd., £34,585; Durham Technical College, N. of England Engineering and Electrical Co. Ltd., £2,083. Recommended.

Guildford B.C. Street lighting London, Worplesdon and Stoke roads, G.E.C. Ltd., £9,187. Recommended.

Islington B.C. Electrical work at Warltersville and Manchester Mansions and 88 Hazelville Rd, Evans and Shea Ltd., £9,512. Recommended.

Middlesex C.C. Electrical installation renewal at John Perryn Primary School, Electrical Contracting Co., £2,459.

Newcastle Hospital Board. Electrical work in: X-ray dept., Hemlington Hospital, Middlesbrough, H. G. Sproates Ltd., £2,265; two extension schemes, Prudhoe and Monkton Hospital, James Scott and Co., £7,805 and £12,483; nurses' training centre, West Cumberland Hospital, G. H. Bowman and Son, £2,633.

Stanley U.D.C. Supply of fittings for new civic hall, G.E.C. Ltd. and Atlas Lighting Ltd.

Stockton-on-Tees T.C. Electrical installation in Hardwick shopping centre, William Bros., £2,04[illegible].

Wandsworth B.C. Electrical installations: in seven groups of dwellings, Elraes Ltd., £1,970; in six groups of dwellings, London E.B., £3,114; in ten groups, S. White (Streatham) Ltd., £4,565.

Washington (Co. Durham) U.D.C. Supply and erection of 11 street lighting units, Engineering and Lighting Equipment Co., £377; cabling by direct labour.

TRADE NOTES

Change of Address. The address of Birfield Ltd. is now 20 Hill St, W.1. The telephone no. remains Grosvenor 7090.

Agents. Findlay Durham and Brodie are acting as the London office of the South African Porcelain Insulator Manufacturers' Association (Pty.) Ltd.

Ealing Branch. Edmundsons Electrical Wholesalers Ltd. have now occupied new premises at Craven Rd, Ealing, W.5, which include a trade counter/display room, offices and stores. This branch, serving the West London postal area, supersedes the temporary premises which had been occupied since the depot in Uxbridge Rd was demolished in 1957.

Regrouping. Marconi's Aeronautical Division is now being regrouped in new premises at Basildon, Essex, where the bulk of the company's aeronautical equipment is manufactured. The existing works were built in 1953 and in the following year the Aeronautical Division's Sales and Contracts Group moved to Basildon from Chelmsford. A new extension has now been completed to house the entire division.

Expansion. The Chloride Electrical Storage Co. Ltd. announce that arrangements have been made under which their South African company, whose factory at East London already manufactures a substantial part of the battery requirements of the Union, will shortly take over the production and distribution of batteries now being sold in the Union and nearby territories under the names Bartleite, Autolite, Prestolite and USL.

BUSINESS PROSPECTS

Aldridge U.D.C. Street lighting programme for 1961 at £7,620 approved.

Amble U.D.C. 38 houses and bungalows planned on Links estate. Surveyor.

Aylesbury. Bucks C.C. plans £400,000 College of Further Education and Technical School. Architect.

Bangor. Welsh Hospital Board, Cathays Park, Cardiff, plan Bryn Menai nurses' home.

Bedlington U.D.C. £273,000 three-storey flats and maisonnettes planned at East Green, Choppington.

Belfast. Liverpool and London and Glove Insurance Co., Bow Bells Hse, Bread St, E.C.4, plan demolition of five-storey property in Wellington Pl and replacement with new building.—T.C. Tender: 36 flats, Fortwilliam Parade, Skegoniel Ave. Architects' Dept., 96 Townsend St.

Birmingham. Stella Properties (Birmingham), subsidiary of A. F. Lilley and Co., 19 Bedford Row, W.C.1, plan three- and 12-storey buildings on Dartmouth St area site.—Corporation to lease land at Barford St and Gooch St to E. F. Cash and Sons, 51 Longmore St.—Gabriel and Co., Aston Cross, plan £18,000 manufacturing premises at Prices Row and Howe St.—Welfare Committee plans site at Handworth for multi-storey home for the aged.

Bolton. Tillotson and Son, Ashleigh, Chorley New Rd, plan new premises.

Brighton. New Welbeck Ltd., Moulescoombe Rd, plan new Westergate Rd factory and office block.—Jaycee Furniture, 23 Regent Hill, plan factory at Falmer Rd, etc., Woodingdean.—Hooper Struve and Co., Royal Spa, Park Hill, plan premises at Falmer Rd/Bexhill Rd.—Sir Basil Spence and Ptnrs, 1 Canonbury Pl, N.1, architects for £1 million Brighton University College, Falmer Rd.—Tender: College of Technology for Brighton Corporation. Architects: R. H. Matthew and S. Johnson Marshall, 24 Park Sq East, N.W.1.

Cambridge. H. Williams and Co., 43 Bedford Sq, W.C.1, architects for F. Winton Smith's factory and offices.

Cheltenham. The Colston Property Holdings, 77 South Audley St, W.1, plan multi-storey car parks.

Chesterfield B.C. Tender: 44 traditional type dwellings on Boythorpe estate. Engineer.

Chislehurst and Sidcup U.D.C. Street lighting programme to include Barnfield Rd, Francis Rd, Augustine Rd, all roads on Chalkpit estate and Ethelbert Rd.

Coventry. Following building plans in vicinity of the Airport: factory for Humber Ltd., Humber Rd; extensions for Harry Ferguson Research Ltd., Siskin Drive; bakery for Enterprise Bakeries, Stonebridge Highway.—Corporation to approve plans for £63,000 hostel for mentally ill and £22,000 sheltered workshop, Torrington Ave.—Calgary and Edmonton Land Co., 33 Avenue Rd, N.W.8, plan point block at Smithford Way.

Crawley. Stevens, Scanlor and Co., 56 Buckingham Gate, S.W.1, architects for K.D.G.'s extensions.

Croydon. 20th Century Electronics, King Henry's Drive, plan factory extensions.—Mechanism Ltd., Gyro Wks, 6a St. George's St, plan factory and offices.—J. C. Tonelli, 88 Milton Rd, plan factory extensions.

Dagenham. R. S. Stevens, 38 Marlow Rd, E.17, plan factory and offices and transformer station at Fowler Rd.—N. Harris and Sons, Dominion Wks, Freshwater Rd, plan two-storey factory.—Pritchett and Gold and E.P.J. Ltd. plan assembly shop extensions, Chequiers La.—May and Baker, Rainham Rd South, plan office block and transport building.

Darlington T.C. Modernisation of electrical equipment in old council houses. Architect.

Dudley. Birmingham Hospital Board to approve scheme for new substation and changeover equipment at Burton Rd Hospital. Cost £12,000.

Durham C.C. Branch library, Boldon Colliery, planned. Architect, F. W. Rought and Sons, Woolsingham Bridge estate, promoters of 55-acre housing scheme, Broomside La.

Eastbourne. Jaeger Co. plan Brampton Rd Trading Estate factory on 1½ acres.—A. H. Hunt (Capacitors), Bendon Valley, S.W.18, plan Brampton Rd estate factory.—F. Bournier and Sons plan shops, office blocks, store, etc., at Pevensey Bay Rd.—Gee, Walker and Slater, 100 Park La, W.1, contractors for £50,000 Photax (London) factory.

Eccles. W. Thorpe and H. Hirst, Smith, 65 Barton Arcade, Deansgate, Manchester 3, architects for Mitchell, Shackleton and Co.'s new Green La machine shop.

Edmonton. Cozens and Sutcliffe, Hyde Wks, Gt. Cambridge Rd, Enfield, plan workshop of 12,000 sq ft on their land for United Steel Co.

Enfield. Planned: Factory at Crown Brickworks site, Crown Rd, for Polak and Schwarz; architects: Edward D. Mills and Ptnrs, 9 Richmond Bldgs, Dean St, W.1.—Factory and office extensions, Lea Valley Rd, for Enfield Tubular Products; architects: Bowyer and Bowyer, 6 Southbury Rd, Enfield Town.—Factory at Queensway for Stadium Ltd.; architect: D. A. Cox, 184 Turkey St.

Esh Winning. Tonay, Durham Rd, Esh Winning, plan factory and offices.

Essex C.C. £67,000 hostel for elderly persons planned at Bevan Ave, Barking. Borough Architect, Barking B.C.

Glasgow. Women's Hall of Residence planned at Cleveden Gdns, W.2, for University.

Gosforth. P. H. Knighton, Benfield Rd, Newcastle Hospital Board's architect for out-patients' department at W. J. Sanderson Orthopaedic Hospital.

Grangemouth T.C. Tender: 20 shops, 36 flats, Kersiebank Ave. Town Planner: P. S. Cocker, 66 Lumley St.

Gt. Missenden. Thurlow, Lucas and Janes, 86 Eastern St, High Wycombe, Bucks, quantity surveyors for C. Stevens and Sons' extensions at Prestwood.

Hastings B.C. Tender: 62 two-storey dwellings, three-year scheme, on site of existing Broomgrove estate houses. Engineer.

High Wycombe. Fleet and Roberts, 33 New St, Aylesbury, Bucks, contractors for Broom and Wade's £67,000 canteen and office block.

Hilton. Wright and Ingram, 11 Campden Hill Rd, W.8, architects for redevelopment of Ingfield Manor as spastics school.

Hull. Frederick Gibberd, 8 Percy St, W.1, architect for new College of Commerce.

Hunts C.C. 12-bed children's home planned at Godmanchester. Architect.—Nursery Rd clinic proposed. Architect.

Ipswich B.C. Tender: Chantry estate aged persons' home for 56 people. Clerk.

Keighley B.C. Tender: Two 12-storey blocks of flats comprising 96 three-bedroom flats and 96 one-bedroom flats. Architect.

Kilkenny T.C. 38 two-storey houses, Walkin St. Architect: J. C. Thompson, 65 O'Connell St, Limerick.

Leics C.C. £10,000 children's home planned, corner St. Mary's Rd, Sileby. Architect.—County Council offices planned at Anstey. Architect.

Lindsey C.C. £44,800 junior training centre and hostel for sub-normal children planned on Wood La area site. Architect.

Liverpool. City Electrical Engineer to carry out further scheme for improvement of street lighting at Kirkby Industrial Estate. Cost £3,000.—Colgate Palmolive, Ordsall La, Trafford Pk, Manchester 5, plan factory on 1½ acres of land at Moorgate Rd.

London. Manning and Clamp, 19 The Green, Richmond, architects for six-storey cold store at Nine Elms Goods Depot.—L.C.C. Welfare Committee approves plans by Bertram Carter, 15 Adeline Pl, W.C.1, for 125-place home for the aged at Warwick Cres, Paddington, W., cost £192,750.—Five-storey paediatrics research building planned

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

M. Alexander (Electrical) Ltd., 40 Stafford St, Liverpool 3. Nom. cap.: £100. Dirs.: Maurice Alexander and Joan M. Kenwright.

J. Barnes (Electrical) Ltd., 4 Oxford St, Salford 5. Electrical engineers, etc. Nom. cap.: £5,000. Dirs.: John Barnes, Herbert Pearson and Arthur K. Seares.

T. Carnell (Electric) Ltd., 68 Glencoe Rd, Sheffield 2. Nom. cap.: £5,000. Dirs.: Trevor A. Carnell and Mrs Margaret M. Carnell.

Charles W. Martin Ltd., 107 Baker St, W.1. Manufacturers of and dealers in lampshades, etc. Nom. cap.: £3,000. Dirs.: Charles W. Martin, Irene S. Martin and Geraldine Martin.

C.B.S. (Electrical Motors) Ltd., Barnwell Hse, Newmarket Rd, Cambridge. Nom. cap.: £1,000. Dirs.: James E. Truelove and John H. Bartram.

Clayton Electrical Industries Ltd., Fairclough St, Clayton, Manchester 11. Nom. cap.: £1,000. Dir.: Ivor Bardsley.

Direct Electric and Radio Ltd., 818 High Rd, N.17. Nom. cap.: £1,000. Dirs.: Harold A. Giddy and Edward C. Higgins.

Electric House (F.G.H.) Ltd., 929 Rochdale Rd, Manchester 9. Retailers, suppliers, manufacturers of and dealers in washing machines, refrigerators, etc. Nom. cap.: £1,000. Dirs.: Francis G. Harding and Eva R. Harding.

Gilberts (Electrical Engineers) Ltd., 72 Dagenham Rd, Romford, Essex. Nom. cap.: £500. To take over the business carried on by Sydney Gilbert at Romford and Hornchurch, etc. Dirs.: Sydney Gilbert and Mrs Lily L. Gilbert.

Harmer and Simmons Holdings Ltd., Roebuck Rd, Hainault, Ilford, Essex. To enter into an agreement with Harold M. Harmer, and to carry on business of engineers and engineering in all branches of science and applied science; manufacturers of and dealers in chemical apparatus, etc. Nom. cap.: £223,000. Dirs.: Harold M. Harmer, Bernard Ingram, William E. Simmons and Reginald J. Glass.

Holden's Electrical Ltd., 74 Banktop, Blackburn, Lancs. To take over business of dealers in electrical domestic appliances carried on at 74 Banktop, Blackburn, etc. Nom. cap.: £1,000. Permanent dirs.: Harold C. Holden and June Holden.

Induction Furnace Installations Ltd. Nom. cap.: £2,000. Dirs.: to be appointed by subs. Subs.: John Byron, 5 Ashview Close, Ashford, Middx; and Mrs Christine Crow, 51 Farrance Rd, Chadwell Heath.

Trade Contractors (Electrical) Ltd., 4 Spring St, W.2. Electricians, etc. Nom. cap.: £1,000. Dirs.: Ronald Moloney and Rudolf F. Fabian.

W. L. Turner and Co. (Westminster) Ltd., 68½ Upper Thames St, E.C.4. To take over the business of wholesalers of electrical goods and merchandise carried on by W. L. Turner and Co., of Victoria St, S.W.1, etc. Nom. cap.: £10,000. Dirs.: to be appointed by subs. Subs.: George H. Sayer and Betty M. Brooks.

H. White (Electrical Contractors) Ltd., 10 Dynevor St, Georgetown, Merthyr Tydfil. To take over business of "H. White," carried on at Merthyr Tydfil; to carry on business of electrical engineers, etc. Nom. cap.: £2,500. Permanent dirs.: Henry White and Mrs R. White.

Business Prospects—Continued

at Guildford St, W.C.1, to cost £400,000.—Dyneley, Luke and Moor, 43 Welbeck St, W.1, architects for Royal College of Veterinary Surgeons' new headquarters, Wimpole St, W.1.—Clyde, Young and B. Engle, 8 New Sq, Lincoln's Inn, W.C.2, architects for reconstruction of the Trinity College of Music, Mandeville Pl, W.1.—Architects' Co-Partnership, 44 Charlotte St, W.1, architects for £674,105 secondary school at Lollard St, S.E., for 1,650 boys.—T. P. Bennett and Son, 43 Bloomsbury Sq, W.C.1, architects for shops and offices planned at 6 Porter St, W.1.—K. Kensall, 18 Sackville St, W.1, quantity surveyors for phase 1 of office building at The Broadway, W.6.—Harris and Porter, 3 Robert St, W.C.2, quantity surveyors for £1 million B.O.A.C. extensions to Victoria airways terminal, stage 2.

Manchester. Extensions to Grosvenor St Institute for the Deaf planned.

Newburn U.D.C. Three-storey flats planned at Throckley. Surveyor.

N. Ireland. William C. Callaghan, 26 Church St, Portadown, architect for 45,000 sq ft factory proposed by Mayfair Manufacturing Co., 57 Effra Rd, S.W.2.

Norwich. £40,300 old people's hostel planned on site of Hill Hse, Hethersett.

Nottingham. Land and General Developments, 8 Berkeley St, W.1, plan five-storey block of shops and offices, King St.

Oxford. Professor Sir Leslie Martin, King's Mill, Shefford, near Cambridge, architect for £½ million group of libraries on Manor Rd site for University.—Murray Ward and Ptnrs, 32 Wigmore St, W.1, architects for Department of Biochemistry.

Peterborough. Oddeninos Property and Investment Co., 52 Berkeley Sq, W.1, plan scheme involving land at Broadway.

Pinner. L.C.C. Welfare Committee plans extensions at Blythwood as home for aged at cost of £91,315.

Reading. Oxford Hospital Board, Banbury Rd, plans Caversham Hill nurses' home.—The Berkshire Printing Co., Oxford Rd, plan development at Craig Ave.—B.C. plan £1,500 traffic signs scheme for loop road west of Reading.

Rochdale. £6,195 proposed provision of sodium street lighting in streets in Joy St estate and conversion of gas lighting to sodium lighting in Syke Rd area streets.

Rotherham. Balfour Laboratories, 13 Industry Rd, Sheffield 9, plan cosmetics factory, Eastwood Trading Estate.—Steel, Peach and Tozer plan research building at Sheffield Rd.

St. Asaph, N. Wales. Pilkington Bros. plan Glascoed Rd factory.

St. Helens. Ministry approve B.C.'s scheme for illumination of unclassified link roads and bus routes with electric standards at £13,900.—B.C. Tender: Contract 2161, 105 Burrows La site dwellings. Clerk.—Tender: Contract 2160, 75 Greenbank No. 2 redevelopment site dwellings. Clerk.

Settle R.D.C. Tender: 54 houses, Goodenber Rd East, High Bentham. Surveyor.

Sheffield. Regional Hospital Board plans £1 million radiotherapy h.q., Whitham Rd, Broomhill. Architects: Adams, Holden and Pearson, 38 Gordon Sq, W.C.1.

Shipley U.D.C. Tender: 63 flats, eight bungalows, Rochester St redevelopment area. Clerk.

Southport. Corporation E.C. sanction new Our Lady of Lourdes R.C. secondary school on 17-acre site, Isle of Wight Farm.

Stafford. Birmingham Hospital Board to approve scheme for reorganisation of electric mains distribution at St. George's Hospital. Cost £28,000.

Stockton-on-Tees. Corporation plans £624 improvement in lighting at Bowesfield La Boys' School and £300 at Bailey St J.M. and Infant School.

Stourbridge. Birmingham Hospital Board to approve £18,500 reorganisation of electric mains at Corbett Hospital.

Strood R.D.C. Tender: 24 dwellings, Grain, Halling, Hoo and Stoke. Engineer and Surveyor.

Sunderland B.C. 550 houses, Town End Farm estate planned (Phase 3).

Thurmaston P.C. £5,000 lighting scheme for the by-pass planned. Clerk.

Tilbury. C.E.G.B. plan establishment of 1,400,000 kW power station adjacent to the existing station. First section to be in operation by 1965.

Tynemouth. Northumberland Whinstone Co., Milburn Hse, Newcastle, plan offices and car park off Coast Rd, North Shields site.

Wigan. Union International Co., 13 West Smithfield, E.C.1, plan abattoir at Hartland Mill.

Wolverhampton. Birmingham Hospital Board to approve scheme for provision of substation and renewal of electrical mains distribution system at Royal Hospital. Cost £19,000.

Workington. Shopping centre planned on Moorclose estate. Borough Engineer.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Croydon Electrical Co. Ltd. and **Foster and Thomas Ltd. (London Electrical Co.).** Creditors to send details to liquidator: G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, by 29 Nov.

Minisales Ltd. Winding-up order dated 24 Oct.

Inter-City Electric Machines Ltd. Resolution for voluntarily winding-up passed at extraordinary general meeting on 21 Oct. Creditors to send details to liquidator: F. M. Montague, 233 High St, Poole, by 30 Nov.

G. Norton and Co. Ltd. Creditors to send details to liquidator: R. A. Haigh, Court Chmbrs, Friar La, Leicester, by 25 Nov.

C.J.R. Electronics Ltd. Mr E. Taylor, 30-32 Grey St, Newcastle upon Tyne, appointed liquidator at extraordinary general meeting on 28 Oct. for the purpose of voluntarily winding-up.

Phipps and Culling (Products) Ltd. Mr A. Kane, 13 Greenend Rd, W.4, appointed liquidator at extraordinary general meeting on 24 Oct. for the purpose of voluntarily winding-up.

Tape Recorder Service Co. Ltd. Mr C. Mannifield, 73 Cheapside, E.C.2, appointed liquidator at extraordinary general meeting on 25 Oct. for the purpose of voluntarily winding-up.

Pool Electrics (Blackpool) Ltd. Meeting of creditors to be held at Blackpool Chamber of Trade, 53 Queen St, on 17 Nov., at 3 p.m.

J. A. Phillips (Electrical) Ltd. Mr K. R. Cork, 19 Eastcheap, E.C.3, appointed liquidator at extraordinary general meeting on 26 Oct.

Spin-a-Disc Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 17 Nov., at 10.15 and 10.45 a.m., respectively.

BANKRUPTCY ACTS

Public Examinations

Liverpool. J. Jones, electrical dealer, carrying on business as Stanley Electric Supplies, at 374 Prescott Rd, Liverpool 13. Public examination: 10.30 a.m., 31 Jan., at Court Hse, Fifth Floor, India Bldgs, Water St, Liverpool 2.

Leicester. N. C. Ward, retailer of electrical appliances, formerly carrying on business as Newline Household Supplies, at 92 Pindar Rd, New Parks estate. Public examination: 10.30 a.m., 20 Jan., at The Castle, Leicester.

Bradford. P. W. Nelson, electrical retailer and engineer, formerly carrying on business as S.R. Services at 551 and 543 Wakefield Rd, Bradford 4, and at 32 Town Gate, Wyke. Public examination: 10.30 a.m., 16 Jan. at County Court, Bradford.

Applications for Discharge

Norwich. G. Love, cycle, radio, electrical engineer, etc., carrying on business as Love Bros., Holt Rd, North Elmham. Order made on 19 Sept. on application for discharge: Discharged as from 19 Oct.

Croydon. A. E. R. Honey, electrical contractor, formerly of 13 Longton Grove, S.E.26. Application for discharge order dated 29 Sept.: Discharged as from 31 July, 1962.

Swindon. F. Kirk, electrical, radio and calor gas engineer, formerly carrying on business at 11 Railway St, Pocklington. Order made on 12 Oct. on application: Discharged subject to certain conditions.

Dividend

Stourbridge. P. J. Dovey, hire proprietor of washing machines, formerly carrying on business at 25a Collis St, Amblecote; at Amblecote Rd, Brierley Hill; and 14 Chapel St, Quarry Bank. Dividend per £: 4¼d, payable at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 22 Nov.

Intended Dividend

Coventry. S. J. Barnes, electrical contractor, formerly carrying on business at 3 Pim St, Antrim Rd, Belfast. Last day for receiving proofs for intended dividend: 23 Nov., to W. H. Haigh, Somerset Hse, 37 Temple St, Birmingham 2.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Col-Dix. 793,487. Class 7. Floor-cleaning and polishing machines, etc. 793,488. Class 9. Vacuum-cleaners, etc. Columbus-Dixon Ltd., Capitol Wks, Empire Way, Wembley, Middx.

Degussa in design. 803,504. Class 9. Apparatus, etc. Deutsche Gold-und Silberscheideanstalt Vormals Roessler, 9 Weissfrauenstrasse, Frankfurt-on-the-Main.

Gold Star. 796,579. Class 11. Refrigerating apparatus, cooking and drying appliances, lighting fittings, etc. Elm Works Ltd., Elm Wks, Summerstown, S.W.17.

Gussie. 799,996. Class 7. Machine for domestic use, etc. 799,998. Class 9. Apparatus, etc. Great Universal Stores Ltd, Devonshire St, Ardwich, Manchester 12.

Hugmaster. 807,449. Class 10. Heaters, etc. David Jedwab (Machinery) Ltd., 8 Hillfield Mansions, Haverstock Hill, N.W.3.

Icemaid. 800,603. Class 11. Refrigerators, etc. Samuel and Son Ltd, Talbot Mills, Ellesmere St, Hulme, Manchester 15.

Impalco aluminium in design. 801,015. Class 9. Apparatus, etc. Imperial Aluminium Co. Ltd., Imperial Chemical Hse, Millbank, S.W.1.

Marwin. B801,334. Class 9. Apparatus, etc. Marshall Ward Ltd., S.S. Bldgs, Devonshire St, Ardwick, Manchester 12.

Pep-Arco. 807,119. Class 7. Pumps, etc. Precision Electrical Products (Stockport) Ltd., Progress Wks, Lytham St, Cole Green, Stockport.

Philitina and **Philigrand.** 806,749/50. Class 9. Apparatus, etc. Philips Electrical Ltd, Century Hse, Shaftesbury Ave, W.C.2.

Plannette. 802,659. Class 11. Fans, blowers, etc. Plannair Ltd., Windfield Hse, Epsom Rd, Leatherhead.

Temvonic. 807,234, and **Vistonic.** 807,235. Class 9. Apparatus, etc. Kingston Control Systems Ltd, Empire Chmbrs, 167 Clarence St, Kingston upon Thames.

Transtab. 801,146. Class 9. Voltage and current stabilisers. Joyce Loebl and Co. Ltd., Princes Way, Team Valley Trading Estate, Gateshead 11.

MEETINGS TO NOTE

THURSDAY, 17 NOV.

I.E.E. (Southern). "Engineering Education of the Technical Universities in Western Germany," D. B. Welbourn, Professor D. B. Spalding and G. L. Ashdown. (Joint meeting with Southern Branch of I.Mech.E.). Central Electricity Generating Board Offices, 111 High St, Portsmouth. 6.30 p.m.

I.E.E. (Irish). "Aviation, Navigational Systems," G. Jones. Physical Laboratory, Trinity College, Dublin. 6 p.m.

SCIENTIFIC INSTRUMENT MANUFACTURERS' ASSOCIATION. Convention at Eastbourne until 20 Nov.

INSTITUTION OF MECHANICAL ENGINEERS (London Graduates). "Recent Developments in L.T.E. Railway Rolling Stock," J. Styles. 1 Birdcage Walk, S.W.1. 6.30 p.m.

FRIDAY, 18 NOV.

I.E.E. (N. Midlands). Annual dinner. Queen's Hotel, Leeds. 7 p.m.

I.E.E. (N. Staffs). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Technical College, Stoke. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS. Chairman's address: "Simple Instruments for Tanks and Pipelines," E. M. Baskerville. Pepys' Hse, 14 Rochester Row, S.W.1. 7 p.m.

MONDAY, 21 NOV.

I.E.E. (N. Western). Discussion: "The Teaching of Electrical Network Theory and Its Applications in Electrical Engineering." Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Eastern). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (W. Utilisation Group). "The Characteristics and Protection of Semiconductor Rectifiers," D. B. Corbyn and N. L. Potter. South Western Electricity Board Demonstration Theatre, Old Bridge, Bath. 6 p.m.

I.E.E. (Sheffield). "Subscriber Trunk Dialling," D. A. Barron. Angel Hotel, Brigg. 7 p.m.

I.E.E. (Reading). "Electronics in the Postal Mail Services," G. P. Copping. George Hotel, King St. 7.15 p.m.

I.E.E. (London Graduates and Students). "Magnetic Amplifiers in Power Engineering," M. J. Pope. Savoy Pl, W.C.2. 6.30 p.m.

BIRMINGHAM ELECTRIC CLUB. "The Fuel Cell—A Logical Development in the Conservation of Natural Resources," P. W. Jones. Grand Hotel. 6.15 p.m.

I.E.S. (Bath and Bristol). "Lighting for Production," W. Guscott. S.W.E.B. Demonstration Theatre, Bristol.

I.E.S. (Leeds). "Eye Strain and Glare Disabilities in Relation to Artificial Lighting," G. Black. British Lighting Council, 24 Aire St. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "50 c/s Single-phase A.C. Electrification on British Railways," J. W. Greeve. Electric Hse. 7.15 p.m.

A.S.E.E. (Bristol and West). "Heavy Industry Control Gear." Grand Hotel, Bristol. 8 p.m.

TUESDAY, 22 NOV.

I.E.E. Joint Meetings with Civils. "The Aswan Hydro-Electric Scheme," V. Furuskog and G. F. Kennedy. Gt. George St, S.W.1. 5.30 p.m.

I.E.E. (Electronics and Communications Section). Conference on Electronic Telephone Exchanges until 24 Nov. Savoy Pl, W.C.2.

I.E.E. (N.W. Supply Group). "The Logical Design of Electrical Networks Using Linear Programming Methods," U. G. W. Knight. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N.E. Graduates and Students). "Operating Mechanisms for Medium Voltage Switchgear," A. Charlton. Sunderland Technical College. 6.30 p.m.

I.E.E. (S. Midlands Graduates and Students). "Automatic TV Assembly," T. L. Harcombe. Training Office, G.E.C., Stoke. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (S. Wales). "Electrical Regulations and Safety in Factories," E. Sutton. Electricity Showrooms, 62 Kingsway, Swansea.

INSTITUTION OF MECHANICAL ENGINEERS (Lubrication Group). Discussion: "Bearing Corrosion." Birdcage Walk, S.W.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Western). "Transistors in Control Circuits," E. Wolfendale. School of Management Studies, Unity St, Bristol 1. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Cheltenham). "The Operation and Control of ERNIE." Belle Vue Hotel. 7.30 p.m.

WEDNESDAY, 23 NOV.

I.E.E. (Southern). "Applications of Operational Research Techniques to C.E.G.B. Plant Problems," A. W. Ingram. C.E.G.B. Offices, 111 High St, Portsmouth. 6.30 p.m.

I.E.E. (S.W. Scotland). "A Survey of Street Lighting and its Future," W. R. Stevens and H. M. Ferguson. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. "Blaenau Ffestiniog and Other Medium Head Pumped Storage Schemes in Great Britain," H. Headland. Birdcage Walk, S.W.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "Objective and Subjective Requirements for Loudspeakers," F. H. Brittain. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Southern). "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," J. S. Shayler. Farnborough Technical College. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Wales). "Radio Navigational Aids in Aircraft." Welsh College of Advanced Technology, Cardiff. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (W. Midlands). Discussion: "The Various Routes to Professional Qualifications in Electronic Engineering." Birmingham University, Edgbaston. 6.15 p.m.

NORFOLK ELECTRICAL CIRCLE. Annual dinner. Flixton Room, Norwich. 7.15 p.m.

THURSDAY, 24 NOV.

I.E.E. (S. Midlands Education Discussion Circle). "The Study of Non-Linear Circuits at Under-Graduate Level." College of Advanced Technology, Birmingham. 6 p.m.

I.E.E. (Rugby Graduates and Students). "Facts on Slots," D. C. MacDonald. College of Engineering Technology. 6.30 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Television Recording: A Survey of the Problems and Methods Currently in Use," J. Redmond. Cavendish Laboratory. 8 p.m.

INSTITUTION OF CIVIL ENGINEERS. Discussion: "The Operation of the General Conditions of Contract for Works of Civil Engineering Construction." Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Sheffield). "The Introduction of Planned Maintenance Systems," A. F. Stedman. Grand Hotel. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Maintenance and Operational Experience of a Data Logging Installation," D. C. Austin. Lecture Theatre, Admin. Bldg., The Associated Ethyl Co. Ltd., Oil Sites Rd, Ellesmere Port, Wirral. 7 p.m.

A.S.E.E. (S. London). "Stage Illumination," F. E. Brown. Greyhound Hotel, High St, Croydon. 8 p.m.

I.E.E. (S. Midlands Graduates and Students). Dinner-dance at The Barn, Hockley Heath. 8 p.m.

FRIDAY, 25 NOV.

I.E.E. (N.E. Graduates and Students). "The Direct Generation of Electricity," B. C. Lindley. Grey Hall, King's College, Newcastle. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. A.G.M. Pepys' Hse, 14 Rochester Row, S.W.1. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (Birmingham). "British Railways Electrification Scheme," W. B. Marrian. Imperial Hotel, Temple St. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish). "Instrumentation of a Space Vehicle," Dr A. E. Roy. Glasgow University. 7.15 p.m.

A.S.E.E. (Coventry and District). "A History of Tape Recording," G. Dawson. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy La, Coventry. 7.30 p.m.

MONDAY, 28 NOV.

I.E.E. (Education Circle). Discussion: "Training for Research." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Mersey and N. Wales). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Setterington. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (S. Midlands Electronics and Measurement). "Static Switching," G. L. Butcher. James Watt Memorial Institute, Birmingham. 6 p.m. Tea 5.30 p.m.

I.E.E. (E. Anglia). "An Introduction to Electronic Computers," R. C. M. Barnes. Electric Hse, Ipswich. 6.30 p.m.

I.E.E. (W. Utilisation Group). "Discrimination Between h.r.c. Fuses," E. Jacks. S. Western Electricity Board Lecture Theatre Centre, Bristol. 6 p.m.

I.E.E. (N. Staffs). "A Survey of Street Lighting and Its Future," W. R. Stevens and H. M. Ferguson. Mechanical Institute, Crewe. 7 p.m.

I.E.S. (Birmingham). "Production of Light Sources." H. R. Ruff. Regent Hse, St. Phillip's Pl, Colmore Row. 6 p.m.

Calcutta Electric Supply

Sales Still Growing

THE sixty-third annual general meeting of the Calcutta Electric Supply Corporation Ltd. was held on 10 Nov. in London, Sir Harry Burn, K.B.E., F.C.A., the chairman, presiding.

Here is an extract from his statement:

Industry continues to expand throughout the whole of the licensed area and housing development proceeds in Calcutta and its suburbs to remedy the shortage of dwelling space for all classes of the population. The demand for energy grows and I am able to report increased sales to all classes of consumers during the year ended 31 March, 1960. The total energy sold increased by 140 million units to 1,817 million units. The major portion of the increase in demand came from industry.

Energy sold for power purposes refers principally to industrial demand, which accounted for 90% of these sales. The balance covers public water works and domestic power, the latter being mostly for air-conditioning and refrigeration. All the principal classes of industrial consumer recorded higher consumption than in any previous years. The jute industry, our largest consumer, increased their demands by 18 million units to 430 million units.

Further progress in modernisation and rationalisation of jute mill machinery has helped to improve trading conditions for this industry, whose exports were the highest for ten years. Next in importance are rolling mills and engineering workshops, whose consumption increased by 32 million units to 243 million units. Expansion will continue when supplies of steel improve. Of the remainder of our industrial consumers the most important are cotton mills, chemical works and paper mills.

Further expansion took place in the demand for low tension industrial power, sales increasing by 14 million units to 114 million units, and the number of consumers again increasing by over 1,000 to more than 15,500.

The effect of the increase in the demand for energy is shown in the revenue account where it will be seen that the receipts from sales of current have risen by over £700,000 to approximately £9,000,000.

It is proposed to pay a final dividend of 4% (actual) on the Ordinary stock making 7½% (actual) for the year. The net earnings for the year have enabled the company further to strengthen its internal finances and also permit of an increase in the final dividend on the Ordinary stock.

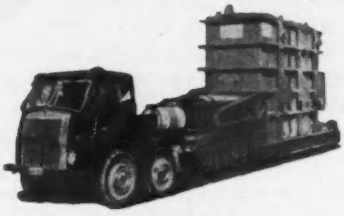
Capital expenditure during the year amounted to £1,160,000 and was almost entirely for our transmission and distribution systems. By far the greater part of the expenditure was on mains and service connections. The forecast of capital expenditure over the next four years based on the anticipated increase in demand indicates an annual outlay of not less than £1¼ million on our transmission and distribution systems.

The report was adopted.

MADE IN ENGLAND – *for the World*

SOUTH AFRICA

Seven 13,333 kVA 88 kV single phase Hackbridge interconnecting transformers to form two 40 MVA 3 phase banks.



AUSTRALIA

Five 30 MVA 132/33 kV. 3-phase Hackbridge transformers for the Electricity Commission of New South Wales.

INDIA

Four 20 MVA 100/6.6 kV. 3-phase Hackbridge transformers for the Tata Hydro Electric Power Supply Co Ltd.

HONG-KONG

Three 5 MVA 33-22/6.6 kV. 3-phase Hackbridge transformers. Photo by courtesy of the China Light and Power Co. Ltd.

ENGLAND

Six 70 MVA 11/134 kV. 3-phase Hackbridge transformers for Skelton Grange Power Station, Leeds

CANADA

Two 60 MVA 125/66 kV Hackbridge transformers for Shawinigan Falls Power Station, Quebec.

OVER 23 MILLION KVA IN WORLD WIDE SERVICE

HACKBRIDGE TRANSFORMERS

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: "Electric, Walton-on-Thames"

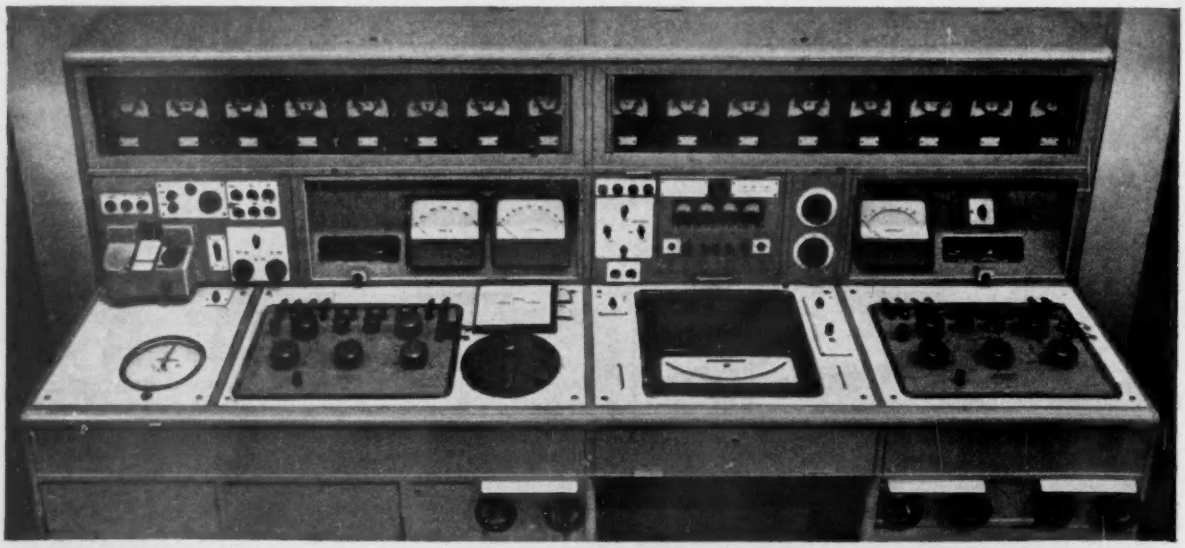
OVERSEAS REPRESENTATIVES: ARGENTINA: H. A. Roberts & Cia., S.R.L. Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria. N.S.W.: Queensland: W. Australia: Elder, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BARBADOS** and surrounding islands: Electric Sales & Service Ltd., St. Michael. **BELGIUM & LUXEMBOURG:** Pierre Pollie, Brussels, 3. **BRAZIL:** Oscar G. Mors, Sao Paulo. **BRITISH GUIANA:** Dandor Commission Agency, Georgetown. **BURMA:** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Ess Ltd., Colombo. **CHILE:** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA:** G. A. Neumann Ltd., Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sahko-ja Konelilke O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE:** Glyndova Ltd. **GREECE:** Charilaos C. Coroneos, Athens. **INDIA:** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper Gilfillan & Co. Ltd., Kuala Lumpur. **NETHERLANDS:** J. Kater, E.I., Ouderkerk a.d. Amstel. **NEW ZEALAND:** Richardson, McCabe & Co. Ltd., Wellington, etc. **PAKISTAN:** The Karachi Radio Co., Karachi, 3. **SOUTH AFRICA:** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION:** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Port of Spain. **TURKEY:** Dr. H. Salim Oker, Ankara. **URUGUAY:** Ciuna Ltda., Montevideo. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA:** Oficina de Ingenieria Sociedad Anonima, Caracas.

SETTING THE STANDARD

MODEL S 200 STANDARDISATION EQUIPMENT

The Standardisation Bench is the heart of the electronic testing equipment which ensures extreme accuracy of calibration of all S 200 meters. A Laboratory Standard Wattmeter and a crystal controlled electronic timer, reading to 1/10th of 1 millisecond, are used for the daily checking of the Rotating Standard. d.c. potentiometers are installed for the regular checking of the Laboratory Standard Wattmeter.

A large Rotating Standard dial presents the average speed of 4 very closely checked Standard Meters. Separate sets of four Standard meters being maintained for each of the various frequency ranges in which meters are supplied. The Standardisation Bench is used to check the Master Meter in each control unit in the final calibration line.



Electronically controlled Standardisation Bench.

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SW/180

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF CHESTERFIELD

Street Lighting A61 Exeter-Leeds Trunk Road

TENDERS are invited for the following:

(1) Supply and delivery of 88 No. Tubular Steel Columns of 25 ft mounting height and 1 No. Steel Wall Bracket.
(2) Supply and delivery of 71 × 140 W Sodium Group "A" medium angled side entry lanterns to accommodate 140 W Sodium Lamps and Jackets.
(3) Supply and delivery of 18 No. 3 × 80 W Fluorescent Lanterns complete with lamps and auxiliary gear for side entry mounting with an alternative quotation for 18 No. 400 W coloured corrected mercury lanterns complete with lamps and auxiliary gear.
(4) Supply and delivery of 71 × 140 W Sodium Lamps and Jackets complete with capacitors and ballast.

Contractors may tender separately for any item or all items. Conditions of Contract and plan may be inspected at the Borough Engineer's Office, Town Hall, Chesterfield. The Specifications, Bills of Quantities and Forms of Tender will be available at the same office during normal office hours upon payment of a deposit of £2 2s, returnable on receipt of a bona fide tender and return of all documents. Tenders in plain sealed envelopes endorsed "Street Lighting, A61" to be delivered to the undersigned not later than 1 Dec., 1960.

The Council do not bind themselves to accept the lowest or any tender.

RICHARD CLEGG,
Town Clerk.

Town Hall,
Chesterfield. (S 606)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

33kv Switchgear for Burghmuir Substation, Perth

TENDERS are invited for the above switchgear, and tender documents may be obtained from the Board's Chief Electrical and Mechanical Engineer, 16 Rothesay Terr, Edinburgh 3, on receipt of a deposit of £2 2s (returnable). The Board do not bind themselves to accept the lowest or any tender. (S 560)

APPOINTMENTS VACANT

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER
(CONSTRUCTION)

REQUIRED at No. 1 Sub-Area Headquarters, Liverpool. Salary within range £1,535/£1,720 p.a. (N.J.B. M/7).

Applicants should have considerable experience in the construction of underground and overhead E.H.V., H.V. and M.V. distribution network including substations and associated equipment, and should possess appropriate technical qualifications. Appointment subject to medical examination. Pension scheme.

Special application forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3, should be returned not later than 30 Nov., 1960. (S 607)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

PLANT SHIFT CONTROL ENGINEER
CASTLE DONINGTON POWER STATION
Vacancy No. 259/60.

APPLICATIONS are invited for the position of Plant Shift Control Engineer at Castle Donington Power Station, near Derby.

Candidates should have had operating experience on large modern pulverised fuel fired boilers and associated turbines.

Salary will be in accordance with Class L, Grade 10 (£1,190/£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 3 Dec., 1960.

GENERAL ASSISTANT ENGINEER
DERBY POWER STATION
Vacancy No. 253/60.

Applications are invited for the position of General Assistant Engineer at Derby Power Station, Full St, Derby.

Candidates should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 26 Nov., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(S 587)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPOINTMENT OF DEPUTY STATION SUPERINTENDENT
HAMS HALL "A," "B" AND "C" POWER STATIONS

APPLICATIONS are invited for the superannuable appointment of Deputy Station Superintendent at Hams Hall "A," "B" and "C" Power Stations. N.J.B. Agreement Conditions. Salary in accordance with Schedule A, Grade N2, i.e. £2,355/£2,565 per annum.

Candidates should have a wide experience in power station operation and maintenance and should have sound administrative ability. The possession of a University Degree in engineering or corporate membership of the Institution of Electrical or Mechanical Engineers will be an advantage.

Apply, quoting Vacancy No. 313/60MD on form AE6 available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warwickshire, by 2 Dec., 1960. (S 595)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
WORTHING DISTRICT

SALARY £965/£1,090 per annum under N.J.B. Class F, Grade 8. The District may be reclassified next year. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 33 kV. The Board has a self-contained flat available for renting.

Applications quoting ET and naming two referees to District Manager, Seeboard, 56 Chapel Rd, Worthing, by 30 Nov., 1960.

ASSISTANT DISTRICT ENGINEER
CENTRAL SUSSEX DISTRICT

Salary £890/£1,015 per annum under N.J.B. Class F, Grade 9. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems. The successful applicant may elect to have a service tenancy of a Board's flat.

Applications quoting ET and naming two referees to District Manager, Seeboard, Electra Hse, Church Rd, Haywards Heath, by 30 Nov., 1960.

ASSISTANT DISTRICT ENGINEER
SUTTON DISTRICT

Salary £1,115/£1,245 per annum under N.J.B. Agreement, Class G, Grade 7, plus £50 p.a. London Weighting. Superannuable. Candidates should preferably hold the H.N.C. or equivalent and have had practical experience in the operation, maintenance and construction of 11 kV and medium voltage underground and overhead distribution systems. The successful applicant will be required to undertake standby duties.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 52 High St, Sutton, Surrey, by 30 Nov., 1960.

ASSISTANT DISTRICT ENGINEER
SUTTON DISTRICT

Salary £965/£1,090 p.a. under N.J.B. Class G, Grade 9, plus London Allowance. Superannuable. Applicants should have had a good general education, be technically trained up to H.N.C. standard and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 52 High St, Sutton, Surrey, by 30 Nov., 1960.

ASSISTANT DISTRICT ENGINEER
SUTTON DISTRICT

Salary £825/£940 p.a. plus London Allowance under N.J.B. Class G, Grade 11. Superannuable. Applicants should possess the H.N.C. in electrical engineering and have had a thorough training in underground and overhead distribution systems.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 52 High St, Sutton, Surrey, by 30 Nov., 1960.

ASSISTANT ENGINEER
(DRAUGHTSMAN)
CROYDON AND PURLEY DISTRICT

Salary £1,165/£1,295 per annum including London Allowance under N.J.B. Class J, Grade 9. Superannuable. Applicants should be suitably qualified and capable of supervising a large District drawing office under the District Engineer. Experience in basic design, layout of substations up to 11 kV, presentation of data and mains and system records is essential.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 30 Nov., 1960.

GEORGE WRAY,
Secretary.
(S 596)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

THE NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEERS
PLANNING SECTION
SUB-AREA ENGINEERING DEPARTMENT
OLDHAM

APPLICANTS should have had experience in L.V. and H.V. system design, protective gear application and system calculations and should preferably be qualified for entry as Graduate of the Institution of Electrical Engineers.

Salary Scale: £965/£1,090 p.a. Grade L.13. N.J.B. Conditions.

FOURTH ASSISTANT ENGINEER (TESTING)
SUB-AREA TESTING SECTION
STALYBRIDGE

Applicants should have a sound knowledge of the application of protective gear to transformer and feeder circuits on systems up to 33 kV and have experience in the commissioning and maintenance testing of such equipment. Experience in applied high voltage testing of cables, switchgear and transformers is also desirable.

Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scale: £965/£1,090 p.a. Grade L.13. N.J.B. Conditions.

FOURTH ASSISTANT ENGINEER
(DRAUGHTSMAN)
SUB-AREA ENGINEERING DEPARTMENT
OLDHAM

Applicants should have had experience in switchgear and control gear diagrams and substation layout.

Salary Scale: £965/£1,090 p.a. Grade L.13. N.J.B. Conditions.

FOURTH ASSISTANT DISTRICT ENGINEER
OLDHAM

Duties include assisting with the operation, maintenance and construction of the distribution system within the district, both overhead and underground up to 33 kV and substations.

Applicants should be suitably qualified and be prepared to undertake standby duties.

Salary Scale: £890/£1,015 p.a. Grade H.11. N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, and returned to him by 30 Nov., 1960. (S 577)

LONDON ELECTRICITY BOARD

DRAUGHTSMEN (2)

APPLICATIONS are invited for the above positions in the Board's Essex Suburban District at 497/9 Ley St, Ilford.

Candidates should have experience on mains recording work, be able to obtain details on site and compile neat and accurate permanent records.

The posts are graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £600/£700 per annum, plus the appropriate London Area Allowance.

Applications giving details of age and experience should be sent to the Administrative Officer at the above address within 14 days of the publication date of this notice. Please quote ref.: PER/V/3086/T. (S 563)

FALKLAND ISLANDS GOVERNMENT

South Georgia

ASSISTANT DIESEL ELECTRIC MECHANIC

REQUIRED for service in South Georgia for one tour of 2-2½ years in first instance. The officer will be provided with free furnished accommodation and with free fuel and lighting. Meals will also be free. Free passages. Liberal leave on full salary. In addition he will be paid a salary according to experience and ability in scale rising to £540 a year. Gratuity at rate of £10 for each completed month of residential service.

Candidates, single and under 40 years of age, must be able to repair and maintain diesel electric (a.c.) generators up to 75 kW and service electrical equipment. Apply to Crown Agents, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51163/EE. (S 555)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted superannuable positions in the Distribution/Transmission (Construction) Section of the Chief Engineer's Department at Board Headquarters:

(1) PRINCIPAL ASSISTANT ENGINEER
(CIVIL) (Ref. E44/60)

Applicants should be Civil Engineers holding a University Degree or Associate Members of the Institution of Civil Engineers. They should have had a wide experience in the design and construction of building and civil engineering works associated with 132 kV and 275 kV substations and also in the design and construction of 132 kV and 275 kV overhead transmission lines. Experience in the preparation of specifications, bills of quantity and in the supervision of contract works is essential and it is desirable that the applicant should possess administrative abilities.

Salary: N.J.M.C., Grade 6c, £2,380/£2,595 per annum.

(2) THIRD ASSISTANT ENGINEER (CIVIL)
(Ref. E45/60)

Applicants should be Civil Engineers and have passed Sections "A" and "B" of the Associate Membership Examination of the Institution of Civil Engineers or hold equivalent qualifications. They should have had at least five years' practical experience in the supervision of civil engineering and building works, the preparation of specifications and bills of quantities. Knowledge of the design and construction of transmission lines, whilst not essential, would be an advantage.

Salary: N.J.B. Class BX, Grade 6, £1,285/£1,610 per annum.

Applications, quoting appropriate reference number, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 2 Dec., 1960. (S 576)

UGANDA GOVERNMENT

Public Works Department

INSPECTOR OF WORKS (ELECTRICAL)

APPLICATIONS are invited for the above posts. Appointment on contract for one tour of 30-36 months in first instance. Salary according to age and experience in scale (including inducement pay) £1,056 rising to £1,341 a year. A Salaries Commission is at present in East Africa reviewing salary scales. Gratuity 13½% of total salary drawn. Outfit allowance £30 payable. Free passages. Liberal leave on full salary.

Candidates, over 30 years, must possess O.N.C. (Electrical) or equivalent qualification, have served a full apprenticeship and had subsequent experience in maintenance of industrial electrical equipment and large installations. They must be fully conversant with U.K. Home Office Electricity Rules, Electricity Regulations under the Factories Act and those of the Electrical Commissioners. Apply to Crown Agents, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/50272/EE. (S 554)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPOINTMENT OF DISTRICT MANAGERS

APPLICATIONS are invited from suitably qualified candidates, with wide experience of the Electricity Supply Industry, for appointment as District Manager in

OSWESTRY DISTRICT from 1 April, 1961.
CREWE DISTRICT from 1 July, 1961.

Salary payable in either instance in accordance with National Joint Managerial Grade 5, Class C (£2,170/£2,380).

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Establishments Officer to the Board, Electricity Hse, Love La, Pall Mall, Liverpool 3. Closing date for return: 16 Dec., 1960.

A single completed form, suitably indicated, will suffice as application for either or both of the appointments. (S 562)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (SHIFT RELIEF)
GROVE ROAD POWER STATION
Vacancy No. 60/930.

Sound technical training with some experience of power station operation. Duties include provision of shift relief, mainly in the Control Room. Salary: Class F, Grade 12, £755/£855 plus £90 shift per annum.

Applications are invited for the following superannuable post. Salary includes London Allowance.

CHEMICAL ASSISTANT
ACTON LANE POWER STATION
Vacancy No. 60/932.

Candidates should have as a minimum G.C.E. in English, Maths, Physics and Chemistry. Day release, in approved cases, up to age 21 for further study. Duties include work in laboratory and on power station plant. Salary rising to £855 per annum.

Applications, quoting Vacancy No., to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London W.1, by 29 Nov., 1960. (S 565)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD, SOUTH CALEDONIA AREA

SENIOR ASSISTANT ENGINEER
(OPERATIONS)

THE applicant will be required to supervise and control system operations up to 33 kV and will be responsible for the direct supervision of a 24-hour Report Centre. He may also be required to organise a programme of maintenance for the distribution network. The system is heavily interconnected with several 132/33 kV substations and generation groups, and covers a very wide rural area. Applicants should have considerable experience of distribution work and preference will be given to Corporate Members of the I.E.E. The appointment is graded G.4 on the N.J.B. Scale at a salary of £1,350/£1,500 per annum.

Applications should be received within 14 days of the appearance of this advertisement on forms obtainable from the Area Manager, Blackfriars, Perth. (S 547)

NIGERIAN COLLEGE OF ARTS, SCIENCE AND TECHNOLOGY

APPLICATIONS are invited for
TECHNOLOGIST OR SENIOR
TECHNOLOGIST (ELECTRICAL)

for the engineering laboratory and workshops for students preparing for University of London B.Sc.(Eng.) in Special Relationship.

Qualifications: H.N.C. or O.N.C. or appropriate City and Guilds qualification in Telecommunications. Good experience on maintenance and construction of electronic equipment and instrument maintenance essential.

Contract Salary Scales: Technologist £756/£1,284 p.a., Senior Technologist £1,140/£1,440 p.a., both plus inducement addition of £180/£330 p.a. for overseas appointees and gratuity at £25 or £37 10s for each completed three months' residential service. Entry point according to qualifications and experience.

Partly furnished quarters at one-twelfth basic salary rental. Tours 15-18 months. Free passages for appointee and wife. Children's passages assistance and maintenance grant up to £150 p.a. if left in U.K.

Applications (eight copies) giving age, qualifications, experience and names of three referees should be sent to The Council for Overseas Colleges, 12 Lincoln's Inn Fields, London W.C.2, by 9 Dec., 1960. (S 579)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

BOURNEMOUTH EDUCATION COMMITTEE

Bournemouth Municipal College of Technology and Commerce, Electrical Engineering Department

REQUIRED for January, 1961, an
ASSISTANT, GRADE B
in the Department of Electrical Engineering, to teach practical subjects of the Electrical Craft Courses.

Applicants should have good industrial experience and be suitably qualified in the theory and practice of Electrical Engineering, including an appropriate City and Guilds Electrical Installations qualification.

The successful candidate will be expected to teach Electrical Workshop Practice and Installations Regulations and Technology, and to assist with other subjects of the City and Guilds and Ordinary National Certificate courses.

Salary according to the Burnham Technical Scale, viz.:

Assistant Grade B, Men, £700/£1,150 per annum, with additions for approved qualifications and training.

Further particulars and form of application may be obtained from the Chief Education Officer, Town Hall, Bournemouth. (S 549)

THE NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the following appointments:

SECOND ASSISTANT DISTRICT ENGINEER
CROOK DISTRICT

Salary: Schedule A, Class E, Grade 7, £965/£1,090. N.J.B. conditions.

THIRD ASSISTANT DISTRICT ENGINEER
DURHAM DISTRICT

Salary: Schedule A, Class G, Grade 9, £965/£1,090. N.J.B. conditions.

Applicants must have had sound practical training and experience in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and auxiliary equipment. Preference will be given to candidates with qualifications leading to Corporate Membership of I.E.E.

Applications, stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (S 582)

COUNTY BOROUGH OF PRESTON

APPLICATIONS are invited for the post of
TECHNICAL ASSISTANT
(APT. II, £815/£960 p.a.)
in the Public Lighting and Electrical Section of the Borough Engineer and Surveyor's Department. Applicants should have had an approved training and be capable draughtsmen with good experience in the preparation of schemes, specifications and estimates for all classes of electrical installation work. Preference will be given to candidates possessing the Higher National Certificate in Electrical Engineering, or equivalent.

Forms of application obtainable from the undersigned, to whom they must be returned by Monday, 28 Nov., 1960.

W. E. E. LOCKLEY,
Town Clerk.

Municipal Bldg,
Preston. (S 568)

COVENTRY CORPORATION

require
FOREMAN (ELECTRICAL)

SALARY: Grade Misc. VII (£810/£875). Approved apprenticeship and considerable experience of contract work and installation, repair and maintenance of industrial and domestic equipment essential. Some experience with a large local authority and National Certificate or City and Guilds an advantage.

Housing accommodation may be available. Application forms from City Engineer, Council Hse, Coventry, returnable by 28 Nov., 1960. (S 583)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

North Staffs. Sub-Area

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (NEWCASTLE)

Applicants should have had experience in contracting, including the preparation of estimates, and in the sale and installation of electrical apparatus. Technical qualifications desirable. Salary: £825/£940 per annum (N.J.B. Grade F.10). Apply, by letter, within ten days, stating age, experience, qualifications, present position and salary to Mr C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

South Staffs. and North Worcs. Sub-Area

FOURTH ASSISTANT ENGINEER
(COMMERCIAL DEPARTMENT)
(HEADQUARTERS)

Applicants should have had experience in the installation of electrical equipment and of preparatory work connected therewith. The successful applicant will be required to assist in all branches of the Department, particularly in the planning and installation of space heating equipment for all purposes. Possession of O.N.C. (Elect. Eng.) is a minimum requirement. Salary: £1,115/£1,245 per annum (N.J.B. Grade M.12). Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr H. A. P. Caddell, Sub-Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

Worcester and District Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER
(REDDITCH/BROMSGROVE)

Duties involve the construction, maintenance and operation of H.V. and L.V. distribution systems. Technical qualifications desirable. Salary: £965/£1,090 per annum (N.J.B. Grade G.9). Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr E. B. Willis, District Manager, Midlands Electricity Board, Windsor Rd, Redditch, Worcs.

SENIOR SERVICE CENTRE ASSISTANT
(MALE) (REDDITCH)

Applicants should be experienced in the sale of electrical appliances and advising consumers in connection therewith. Salary: £700/£775 per annum (N.J.C. Grade 2). Apply, by letter, within ten days, to Mr E. B. Willis, District Manager, Midlands Electricity Board, Windsor Rd, Redditch, Worcs.

F. W. CATER,
Secretary.
(S 571)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER (DISTRICT)

FOURTH Assistant Engineer is required in the Birmingham District of the Electrical Department.

N.J.B. Agreement conditions, superannuable appointment, salary within Schedule B, Class BX, either Grade 9, 10 or 11, according to qualifications and experience. The salary ranges are as follows:

Grade 9 £1,005/£1,325 per annum.
„ 10 £935/£1,245 per annum.
„ 11 £855/£1,165 per annum.

Candidates should possess a Higher National Certificate in Electrical Engineering, or an equivalent qualification, and should preferably have had some experience on any type of equipment associated with E.H.V. transmission.

Apply quoting Vacancy No. 310/60MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, to reach him not later than 3 Dec., 1960. (S 564)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

ASSISTANT ENGINEER (OPERATION)
Vacancy No. ET/AV/162/60.

REQUIRED at Berkeley Nuclear Power Station.

Superannuation Scheme. Salary: N.J.B. Class M, Grade 14, Scale 7, £965/£1,090 per annum.

Applicants should have received a thorough basic training in power station practice and obtained technical qualifications at least to Higher National Certificate standard. The successful applicant will be employed on technical duties connected with the commissioning, testing and operation of nuclear reactors and their associated generating plant.

Closing date: 2 Dec., 1960.

ASSISTANT ENGINEER
(MAINTENANCE PLANNING)
Vacancy No. ET/AV/163/60.

Required at Berkeley Nuclear Power Station.

Superannuation Scheme: Salary: N.J.B. Class M, Grade 10, Scale 11, £1,275/£1,410 per annum.

Duties will include supervising the day-to-day running of the maintenance records office and assisting in the preparation of the maintenance programmes. Some experience of industrial planned preventive maintenance schemes and qualifications up to H.N.C. would be an advantage. The successful applicant may also be required to undertake a limited amount of work study, but training in this field will be given if necessary.

Closing date: 2 Dec., 1960.

ASSISTANT ENGINEER
(ELECTRICAL MAINTENANCE)
Vacancy No. ET/AV/164/60.

Required at Berkeley Nuclear Power Station.

Superannuation Scheme. Salary: N.J.B. Class M, Grade 12, Scale 9, £1,115/£1,245 per annum.

Duties will consist primarily of the repair and maintenance of the reactor fuel handling machines and control system. The work will involve the finding and clearance of faults in extensive automatic systems and suitable experience or aptitude for this type of work is desirable. The engineer appointed would be required to work unaided and/or with skilled craftsmen. Possession of technical qualifications up to H.N.C. are desirable.

Closing date: 30 Nov., 1960.

ASSISTANT ENGINEER
(MAINTENANCE)
Vacancy No. ET/AV/165/60.

Required at Berkeley Nuclear Power Station.

Superannuation Scheme. Salary: N.J.B. Class M, Grade 14, Scale 7, £965/£1,090 per annum.

Duties will consist primarily of preparation of technical diagrams, sketches for maintenance instruction purposes and the filing and recording of station drawings. An aptitude for technical drawing, some drawing office training and technical qualifications up to H.N.C. would be an advantage.

Closing date: 30 Nov., 1960.

These positions offer excellent opportunities for promotion to more senior posts in any of the Board's Nuclear Power Stations. Previous experience in power station work an advantage but not essential.

ASSISTANT CHEMIST
(FOURTH ASSISTANT)
Vacancy No. ET/AV/166/60

Required in the Generation Department (South Group) based at Plymouth.

Superannuation Scheme. Salary: N.J.B. Class AX, Grade 11, Scale 7, £855/£1,090 per annum.

Candidates should have a minimum qualification of H.N.C. in Chemistry and should have a sound knowledge of all branches of chemical analysis. Experience in metallurgy and metallography will be an advantage. Power station experience although desirable is not essential.

Closing date: 28 Nov., 1960.

Applications on form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by the date stated. Please quote Vacancy No. (S 598)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following positions. Successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

THIRD ASSISTANT ENGINEERS
(a) HEMEL HEMPSTEAD DISTRICT
304/60.R.
(b) CLACTON DISTRICT
308/60.N.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems, including substations, at voltages up to and including 33 kV.

Salary: N.J.B. (a) Class F, Grade 9 £890/£1,015); (b) Class E, Grade 9 (£825/£940).

Apply by letter, by 2 Dec., 1960, to:
(a) The Manager, Hemel Hempstead District, Eastern Electricity Board, Bridge St, Hemel Hempstead, Herts.
(b) S. N. Boyne, A.M.I.E.E., Manager, Clacton District, Eastern Electricity Board, 56/58 Station Rd, Clacton-on-Sea, Essex.

Essex Sub-Area

SUB-AREA HEADQUARTERS
Nr. BRENTWOOD
THIRD ASSISTANT ENGINEER
(CONTROL) (SHIFT DUTIES)
305/60.R.

Candidates should have had a wide experience in the operation and control of a large high-voltage distribution system; be fully conversant with the Central Electricity Safety Rules (Distribution), and be capable of taking charge of all system operation in the Essex Sub-Area during their shift.

Salary: N.J.B. Class L, Grade 10 (£1,190/£1,325) plus 10% Shift Allowance, plus London Allowance.

Apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, nr. Brentwood, Essex, by 2 Dec., 1960.

Northmet Sub-Area

HORNSEY DISTRICT
SECOND ASSISTANT ENGINEER
(Ref. 1016)
307/60.R.

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of underground distribution systems at voltages up to and including 33 kV.

Salary: N.J.B. Class G, Grade 7 (£1,115/£1,245), plus London Allowance.

Apply by letter to C. Bradley, M.I.E.E., Manager, Eastern Electricity Board, The Broadway, Crouch End, London N.8, by 28 Nov., 1960. (S 597)

THE SOUTH WALES ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for the position of First Assistant District Commercial Engineer in the Pontypridd/Caerphilly District, based at Pontypridd, in the Cardiff and East Central Area.

Candidates should have had a good general and technical education and possess a minimum qualification of the Higher National Certificate in Electrical Engineering.

Duties will be to assist the District Commercial Engineer in all commercial activities, including load development, public lighting, appliance sales and installation contracting.

The successful candidate will be required to live in or near Pontypridd.

Salary: N.J.B. Class F, Grade 4, Scale 11, £1,275/£1,410 per annum.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445-447 Cowbridge Rd East, Cardiff, to arrive not later than Saturday, 3 Dec., 1960.

Please quote reference 206/60/ET endorsing envelope "First Assistant D.C.E."

R. G. WILLIAMS,
Secretary.
(S 581)

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY, LONDON, E.C.1.

APPLICATIONS are invited, especially from those in industry, for the following appointments:

(a) LECTURER IN ELECTRICAL POWER AND MACHINES
(b) LECTURER IN ELECTRONICS OR MEASUREMENTS
(c) LECTURER IN GENERAL ELECTRICAL ENGINEERING
(d) ASSISTANT LECTURER IN GENERAL ELECTRICAL ENGINEERING

The work of the Department is concerned with the B.Sc.(Eng.) Internal Degree of the University of London, Industrially-Based Sandwich Course leading to the Diploma in Technology (Dip. Tech(Eng.)). Postgraduate courses in Electrical Engineering, and Full-time Research.

The posts also provide facilities for research, development and experience in industrial liaison. Applicants should possess a Degree in Electrical Engineering, and will be encouraged to read for a Higher Degree.

SALARY SCALES:
LECTURER:
£1,370 x £35—£1,550 per annum.
ASSISTANT LECTURER:
£895 x £27 10s—£1,345 per annum.

Plus, in each case, a London Allowance of £38 increasing to £51 at age 37. Starting salary dependent upon industrial or teaching experience.

Particulars and form of application from the Secretary, Northampton College of Advanced Technology, St. John St, E.C.1. (S 586)

SOUTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

REGIONAL ENGINEER'S DEPARTMENT

APPLICATIONS are invited for appointments on the permanent staff of the Board generally in accordance with the Whitley Council conditions of service.

The Board is undertaking a considerable programme of hospital development and the persons appointed will be engaged on varied and interesting work.

MAIN GRADE ENGINEERS

Applicants should be (i) Corporate Members of the Institution of Electrical Engineers or (ii) have passed the Institution's examination, and be Graduate Members, and be experienced in the preparation of specifications, drawings and estimates for electrical installations in hospitals and large public buildings.

Salary Scale: £910 x £35(1) x £40(2) x £45(5) x £50(7)—£1,600. Bar at £1,205 for graduate members of the Institution. Corporate members commence between £1,160 and £1,300. London Weighting allowance of £40-£50 p.a. payable in addition.

Applications stating age, qualifications, experience, present appointment and salary, together with the names and addresses of three referees, should be sent to the undersigned at 40 Eastbourne Ter, London W.2, by not later than 1 Dec.

E. G. BRAITHWAITE,
Secretary.
(S 591)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

CROYDON DISTRICT
FOURTH ASSISTANT ENGINEER
Vacancy No. 52A/60T.

REQUIRED for transmission operation and maintenance on 275 kV and 132 kV overhead lines, cables and substations in the Croydon District of the Electrical Department.

Salary within the range £905/£1,295 per annum including London Allowance, Class AX, Grade 11, 10 or 9, according to experience and qualifications.

Applications giving age, details of experience, qualifications etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 3 Dec., 1960.

W. H. DUNKLEY,
Divisional Controller.
(S 590)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. Schedule A appointments in the South Wales Division.

ASSISTANT ENGINEER
(COMBUSTION AND EFFICIENCY)
CARDIFF POWER STATION
Vacancy No. 304/ET/60.

Salary: Class F, Grade 7, Scale 8 (£1,040/£1,165 per annum).

Applicants should possess H.N.C. or equivalent qualifications. Experience in a modern Power Station and knowledge of Automatic Combustion Control Equipment desirable.

SHIFT CHARGE ENGINEER
TIR JOHN POWER STATION
SWANSEA
Vacancy No. 305/ET/60.

Salary: Class H, Grade 7, Scale 10 (£1,190/£1,325 per annum), plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications, and have had operating experience in a modern Power Station.

ASSISTANT MAINTENANCE ENGINEER
(MECHANICAL)
USKMOUTH "A" POWER STATION
WEST NASH, Nr. NEWPORT, MON.
(RE-ADVERTISEMENT)
Vacancy No. 306/ET/60.

Salary: Class K, Grade 8, Scale 11 (£1,275/£1,410 per annum).

Applicants should possess H.N.C. or equivalent qualifications, and have had experience in a modern Power Station.

Previous applicants need not re-apply.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 3 Dec., 1960. (S 589)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEERS
(TWO)

APPLICATIONS are invited for the above positions in the Board's East End District at 255-279 Cambridge Heath Rd, Bethnal Green, E.2.

Applicants should have had a sound technical education to the standard of the Higher National Certificate, and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

The posts are graded under Schedule A of the National Joint Board Agreement as Class H, one Grade 9 (£1,090/£1,215 per annum inclusive), and one Grade 10 (£1,015/£1,140 per annum inclusive).

Application in writing should be made to the District Manager at the above address, within 14 days of the publication date of this notice. Please quote Ref.: PER/V/3064/T. (S 592)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 302/ET/60.

APPLICATIONS invited for the superannuable N.J.B. appointment of
SENIOR ASSISTANT ENGINEER
in the Chief Generation Engineers Department, Divisional Headquarters, Cardiff.

Salary: Schedule B, Class AX, Grade 3, Scale 15 (£1,570/£1,830 per annum).

Applicants should have a thorough knowledge of steam turbine construction, operation and maintenance. Experience in a large turbine manufacturer's works an advantage.

The successful applicant must be able to assist the Chief Generation Engineer with Power Station engineering matters, to work largely on his own initiative and to prepare clear, concise reports on engineering problems.

Applicants should preferably be Corporate Members of the Institution of Mechanical and/or Electrical Engineers.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 3 Dec., 1960. (S 585)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment:

GENERAL ASSISTANT ENGINEER
RYE HOUSE GENERATING STATION
(HODDESDON, HERTS)

Salary within the range of £625/805 per annum, plus £90 Shift Allowance when required to work on shift.

The commencing salary will depend upon the duties and responsibilities.

Duties include assisting in the Electrical Control Room and experience in the technical operation of electrical, boiler house, and turbine house plant, testing, etc. The post will provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be an advantage.

Applications, quoting reference S.V. No. 1406, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 26 Nov., 1960. (S 550)

THE EAST MIDLANDS ELECTRICITY BOARD
Northamptonshire Sub-Area

FOURTH ASSISTANT DISTRICT ENGINEER
BLETCHLEY, DISTRICT
Vacancy No. 127/60.

SALARY: N.J.B. Class F, Grade 10-13 (£670/£940 per annum), according to the technical qualifications and experience of the candidate.

Duties of the successful candidate will be to assist in the Construction, Operation and Maintenance of the H.V. and M.V. system in the District.

Applications giving details of age, present position and salary, qualifications and experience should be addressed to The Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, within 14 days of the date of this advertisement. (S 588)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

ASSISTANT MAINTENANCE ENGINEER
(MECHANICAL)

REQUIRED at Meaford "A," "B" and Stoke Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade L.10, £1,190/£1,325 per annum.

A sound technical training and practical experience in mechanical maintenance is required, preferably in a modern power station and the possession of an appropriate technical qualification will be an advantage.

Apply, quoting Vacancy No. 312/60MD on form AE6, available from the Station Superintendent, Meaford "A," "B" and Stoke Power Stations, Nr. Stone, Staffs, to whom they should be returned to arrive not later than 28 Nov., 1960. (S 593)

H.M. PRISON, LEYHILL, GLOS.

CIVILIAN INSTRUCTIONAL OFFICERS
GRADE III

REQUIRED for Electrical Installation Work (Vocational Training). Aged at least 30 on 15 Dec., 1960. Qualification: full apprenticeship plus at least five years' industrial experience in electrical installation work. City and Guilds Certificate (or equivalent) and some teaching experience desirable. Able to instruct in theory and practice to City and Guilds intermediate and final standards.

Provincial salary scale: £930/£1,000 per annum. 44-hour week and holidays with pay. Prospects of pensionable appointment. A bungalow quarter may be available for renting.

Write: Prison Commission, R.305/291, Horseferry Hse, Dean Ryle St, London S.W.1, for application form.

Closing date: 1 Dec., 1960. (S 570)

YORKSHIRE ELECTRICITY BOARD
No. 7 (Grimsby) Sub-Area

SECOND ASSISTANT ENGINEER
(GENERAL DEVELOPMENT)

APPLICANTS should have had wide experience of the Commercial activities within the Electricity Supply Industry. Technical qualifications would be an advantage.

Salary: N.J.B. Class K, Grade 7 (Scale 12), £1,350/£1,500 per annum.

GAINSBOROUGH DISTRICT
SENIOR SALES REPRESENTATIVE

Applicants must be capable of advising on supply matters, tariffs, apparatus and sales to consumers with domestic and small commercial or industrial installations. Experience on rural development and the application of electricity for agricultural purposes would be an advantage.

Salary: N.J.C. Grade 2, £700 × £25—£775 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 2 Dec., 1960. (S 584)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Ironbridge Power Station. N.J.B. Service Conditions, superannuable appointment, salary within Schedule A, Grade J.9, £1,115/£1,245 per annum, plus 10% shift duties.

A sound technical training and practical power station experience are required, in the operation of steam generating plant and main switchgear. Appropriate technical qualifications an advantage.

Apply, quoting vacancy No. 314/60MD on forms AE6, which are available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to be completed and returned not later than 28 Nov., 1960. (S 594)

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women for work on the examination of Patent applications. Age at least 21 and under 29 (36 for Examiners), with extension for regular Forces service and Overseas Civil Service. Qualifications: normally first or second class honours degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g. A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E. A.R.I.C. London salary (men): £655/£1,460; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S/128/60, and stating date of birth. (S 569)

ELECTRICIANS

Examine this new book on conduit bending

FREE

Thousands in use at present time. Quantity discount to schools and to J.A.C. classes.

CONDUIT BENDING—
—SELF-TAUGHT

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103 pages, 8½ by 11, 15 tables, 106 illustrations, $2.00, written by an electrician with over 20 years' experience installing, teaching and inspecting electrical wiring.

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U.S.A.

No C.O.D.'S (S 575)

BRITISH Engine Boiler and Electrical Insurance Co. Ltd., Longridge Hse, Manchester 4. ELECTRICAL SURVEYOR required in Scotland, also Manchester. Permanent position carrying progressive salary scale £800/£1,100 and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. (S 601)

CABLE ENGINEERS required at North Kent factory to assist in design of super-tension, including oil filled pressure cables. Previous experience in this field is desirable and applicants should be of at least O.N.C. standard. Good salary according to qualifications and experience in a position that offers excellent prospects in an expanding organisation.—Write full details: Box No. 8069, Electrical Times. (S 556)

ELECTRICAL ENGINEER

for Nuclear Group

The de Havilland Engine Co. Ltd. invite applications for the above position.

Applicants, who should not be less than 25 years of age, must have served an indentured apprenticeship in Electrical Engineering and be either a graduate of the Institution of Electrical Engineers or hold the Higher National Certificate and have theoretical knowledge and practical experience in the following fields:

A.C. and D.C. rotating machinery, switchgear, control gear, protective systems, instrumentation, industrial electronics and electrical installations.

Salary according to age, qualifications and experience.

Written applications only, to:

The Personnel Officer,
The de Havilland Engine Co. Ltd.,
Stag La, Edgware, Middlesex.

(S 580)

Ferranti

The Largest Manufacturer of Integrating Electricity Meters in the British Commonwealth, with Overseas Subsidiaries and world-wide trade,

invites applications from

ENGINEERS & PHYSICISTS

to participate in an expanding programme of

RESEARCH & DEVELOPMENT

not only in the field of integrating electricity meters, but also in associated fields such as

- ★ **REMOTE METERING**
- ★ **COSTING AND BILLING DEVICES FOR METERING**
- ★ **ELECTROMAGNETIC COUNTERS**
- ★ **COIN-OPERATED TIME-VENDING MECHANISMS**
- ★ **RELAYS**
- ★ **TIME-SEQUENCE SWITCHING DEVICES**
- ★ **TEMPERATURE-MEASUREMENT AND CONTROL**

Applicants should be of Graduate status and possess good research and development experience.

INTERVIEWS WILL BE HELD IN MANCHESTER OR LONDON

Brief details of qualifications and experience should be sent to T. J. Lunt, Staff Manager, Ferranti Limited, Hollinwood, Lancs, quoting reference MW.

(S 561)

CROMPTON PARKINSON LTD. have a vacancy for a SENIOR DRAUGHTSMAN at their Transformer Works, Hayes, Middx. Applicants should have previous experience on Large Power Transformers.

Write stating details of education, experience, age and salary required to Personnel Officer, B.E.T. Co. Ltd., Clayton Rd, Hayes, Middx. (S 599)

ELECTRICAL ENGINEERING ASSISTANT required with experience in preparing specifications for new electrical installations in buildings. Up to £950. Pensionable. Prospect of advancement in entry grade up to £1,250 for those obtaining H.N.C.(Elec.). Form from Chief Engineer (GS/ET/2882/11), L.C.C., County Hall, S.E.1. (S 553)

ELECTRICAL ENGINEER required for Glasgow Office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (S 600)

MECHANICAL AND/OR ELECTRICAL MEASURING SURVEYOR required in quantity surveyors' office in Berkshire. Practical knowledge of M. and E. services essential. Experience of measuring desirable but not essential.—Write giving full particulars to Box No. 8073, Electrical Times. (S 558)

THE OVERSEAS ENGINEERING DEPARTMENT

of the

DUNLOP RUBBER COMPANY LIMITED

has a vacancy for an

ELECTRICAL DRAUGHTSMAN

to carry out design and detail work in connection with electrical installations in Overseas Factories of the Dunlop Group.

This is an ideal opportunity for a young engineer, having experience of A.C. and D.C. motor control schemes, H.T. and L.T. distribution layouts and lighting installations. Minimum qualification required is O.N.C.—Electrical.

The appointment is pensionable to those under 44 years at the time of engagement and the person appointed will be employed at Fort Dunlop, Birmingham.

Please write, giving age, experience and commencing salary expected to:

Staff Officer, Employment Department,
Fort Dunlop, Erdington, Birmingham 24

(S 567)

ELECTRICAL DEVELOPMENT ENGINEER

With experience in design and testing of Transformers and Battery Charging equipment.

ELECTRICAL DEVELOPMENT ENGINEER

With experience in design and testing I.V. Control Gear.

These vacancies are due to the expansion programme of Britain's Leading Fork Truck Manufacturer, whose factory is situated on the outskirts of a pleasant country town, one hour west of London.

Apply in first instance with full particulars to:

J. Dewar,
Personnel Manager,
Lansing Bagnall Ltd.,
Kingsclere Road, Basingstoke,
Hants.

(S 378)

DOULTON INSULATORS

SALES ENGINEER —ELECTRICAL

An exceptional opportunity occurs for a young engineer with qualifications up to H.N.C. and sound basic training, preferably connected with insulation problems. Experience in the fields of switchgear or transmission line practice would be an advantage.

The successful applicant will be located in London and his duties will involve speciality technical sales work with exceptional opportunities for advancement in an expanding organisation.

Apply in writing, stating salary required, to The Sales Director, Doulton Industrial Porcelains Ltd., Doulton Hse, Albert Embankment, London S.E.1. (S 605)

OVE ARUP and Partners require an ASSISTANT ELECTRICAL ENGINEER to work with a young and expanding group of Architects and Engineers on a variety of projects including University, Industrial and Housing work. Applicants should be experienced in the design of electrical services for all types of buildings and prepared to work as a member of the design team.—Please write to 13 Fitzroy St, W.1. (S 566)

RAPIDLY expanding Manufacturing Electrical Engineers require AGENT/REPRESENTATIVE for Lancashire and Cheshire, with enthusiasm and drive.—Box No. 8075, Electrical Times. (S 559)

THE ELECTRIC CONSTRUCTION COMPANY LIMITED

BUSHBURY ENGINEERING WORKS WOLVERHAMPTON

Attractive Vacancy for

SENIOR SALES ENGINEER

for the Yorkshire Area

Experienced in the layout of Rotating Electrical Plant (medium and large), Automatic Control Gear, Switchgear, Rectifiers, Power Transformers.

The position carries excellent prospects. Valuable pension scheme in operation.

Sales Experience Essential

Apply: Mr J. Johnson Smith, M.I.E.E., The Electric Construction Co. Ltd., "Bushbury Hse," 4 Laurel Mount, St. Mary's Rd, Leeds 7. (S 604)

AAC

RHOKANA CORPORATION LIMITED

Northern Rhodesia

SECTIONAL ENGINEER — ELECTRICAL

Applications are invited from suitably qualified candidates for a position as Sectional Engineer—Electrical, with Rhokana Corporation Limited in Northern Rhodesia.

The successful applicant should be not less than 25 years of age and have had general experience in testing, commissioning and maintaining of electronic and light current devices and control circuits associated with the control of processes as applied to heavy industrial and mining requirements.

He must also be capable of developing, as and when the need arises, new electronic and light current control devices with a minimum of supervision, and be capable of applying and commissioning such developments for use in heavy industrial and mining work.

Salary will be commensurate with qualifications and experience, but in any event will not be less than £141 1s 6d per month, plus a variable cost of living allowance which at present is approximately £5 per month.

Conditions of employment include married/single accommodation at subeconomic rental, medical scheme, pension and life assurance schemes and participation in the metal bonus scheme, which at present is approximately 30% of annual earnings.

Applications in writing, stating qualifications, experience, age and marital status should be addressed by air mail to:

The Personnel Manager,
Rhokana Corporation Limited,
P.O. Box 2000,
Kitwe,
Northern Rhodesia.

(S 436)

J. & P.

PRODUCTION MANAGER FOR SOUTH AFRICA

A senior executive is required to be responsible for all production functions in an important switchgear factory near Johannesburg. Applicants should have had considerable practical experience in production management. Experience in switchgear manufacture is desirable but not essential. Substantial scope for advancement will be available to the successful candidate and the position to be filled offers considerable interest since there is currently in hand a considerable factory extension programme. Candidates who would like to discuss this vacancy are requested to send a brief outline of their experience and career to the Director and General Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, London S.E.7.

(S 574)

SUPERVISING ENGINEER. Must be experienced estimator in all types of commercial and industrial electrical installations. Write full details of training and experience to: The Manager, F. H. Wheeler and Co. Ltd., 52 Elswick Rd, Newcastle upon Tyne 4. (S 511)

AT

MECHANICAL ENGINEERING DRAUGHTSMEN

Men fully experienced on mechanical design of high-precision automatic machinery required by ASSOCIATED TRANSISTORS LIMITED for their new 18-acre factory at Basingstoke in Hampshire. Excellent opportunities in a rapidly growing organisation, especially for those with previous experience in the electronic industry.
Location at Basingstoke *OR* South Ruislip. Pension and Life Assurance. Resettlement assistance. *Please write full details of training and experience to:*

The Personnel Manager,

ASSOCIATED TRANSISTORS LTD.,

Stonefield Way, Victoria Road,
South Ruislip,
Middlesex.

(S 548)

BRITISH BROADCASTING CORPORATION

requires Engineer in Planning and Installation Department, London, initially to undertake work on power installations for transmitter and studio premises. Preference given to applicants capable of extending their field of activity to installation, testing and commissioning of radio frequency equipment. Opportunities to gain necessary experience. Applicants must be British subjects preferably holding qualifications recognised for Graduate Membership of I.E.E. and should have had site installation practice and practical experience in manufacturer's works. Specific experience of diesel alternator installations desirable but not essential. Salary, commensurate with qualifications and experience, in scale £1,230/£1,580 p.a. Requests for application forms to Engineering Recruitment Officer, Broadcasting Hse, London W.1, quoting reference: 60.E.163.E.T.

(S 608)

NUCLEAR SAFETY

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

has vacancies in the

SAFEGUARDS DIVISION OF ITS HEALTH AND SAFETY BRANCH AT RISLEY

Teams of engineers and technologists with a wide range of training and experience are needed to assess the safety of designs for various types of nuclear reactors, chemical plant and experimental facilities both within and outside the Authority. Posts are available at junior and senior levels for:

PHYSICISTS

interested in the analysis of problems of nuclear reactors.

CHEMISTS

wishing to study the effects produced by the irradiation of reactor materials.

METALLURGISTS OR MECHANICAL ENGINEERS

wishing to specialise in reactor containment technology.

MECHANICAL, ELECTRICAL OR ELECTRONICS ENGINEERS

interested in the problems of reactor design, instrumentation and operation.

PHYSICISTS, CHEMISTS OR ENGINEERS

wishing to specialise in criticality control.

Applicants must have an Honours Degree or equivalent and at least three years' relevant industrial or research experience, or be corporate members of a senior professional Institution. For the more senior posts wide experience is required.

Salaries will be on scales between **£860 and £2,180** *according to qualifications and experience.*

Contributory Superannuation. Housing Assistance Schemes.

Send postcard for application form quoting ref. H.16/J8 to:

The Administration Manager,

U K A E A

AUTHORITY HEALTH AND SAFETY BRANCH

RISLEY, WARRINGTON, LANCS.

CLOSING DATE: 5 DECEMBER, 1960

(S 552)

SENIOR CABLE ESTIMATOR required. Candidates must be fully experienced in the preparation and submission of Tenders for mains and plastic cable—Home and Export. Pension Scheme. Applicants must give age and details of experience which will be treated in strict confidence. Apply Box No. 8067, Electrical Times. (S 518)

WORKS MANAGER required for switchgear factory in Scotland. Must be capable of developing organisation and taking full control. Excellent prospects offered to right class of man having switchgear experience. All applications will be considered in strict confidence by the Managing Director.—Apply Box No. 8071, Electrical Times. (S 557)

THE ESSO PETROLEUM COMPANY LIMITED

invites applications for the following position at their Refinery at Fawley, near Southampton:

ELECTRICAL PROJECT ENGINEER

for the design and preparation of estimates, specifications and system calculations associated with high voltage substations, distribution systems, large H.V. machines and electric power and lighting installations for all types of oil refinery and chemical processes. Previous estimating and design experience is essential, and preference will be given to candidates with some maintenance and installation experience. Minimum technical qualifications equivalent to Corporate Membership of the Institute of Electrical Engineers.

There is a Contributory Pension Scheme, Sickness and Accident Benefit Scheme, and a Comprehensive Appraisal Development Scheme.

The Esso Refinery is on the west side of Southampton Water and on the borders of the New Forest.

Applicants should send full details of education and experience, quoting this journal, to the:

Employee Relations Superintendent,
Esso Refinery,
Fawley,
Nr. Southampton,
Hampshire.

(S 578)

OPPORTUNITY WITH A FUTURE

To deal with an increasing volume of business we require additional Sales Engineers experienced in handling either home or overseas inquiries for H.V. and M.V. Switchgear, Transformers and Contactor equipment. There is wide scope and opportunity for the right men who must have the essential qualities of drive and initiative. Technical qualifications up to H.N.C. level are preferred.

The working conditions are pleasant and congenial in a modern switchgear manufacturing organisation.

Write in the first instance to:
The Chief Sales Engineer,
South Wales Switchgear Ltd.,
Blackwood, Monmouthshire.

(S 602)

ELECTRICAL ENGINEER

Applications are invited from well qualified and experienced Electrical Engineers for the senior electrical appointment in a large British mining concern in West Africa.

Candidates, who must possess a Higher National Certificate or Engineering degree, should have previous mining engineering experience and have served a full apprenticeship. The preferred age is 27 to 40.

This is a permanent appointment arranged in 15-month foreign tours followed by three months' leave. The Company provides passages and housing. Although in a tropical climate the post is healthy and suitable for children.

The starting salary will depend on the age and qualifications of the individual. The Company operates a non-contributory pension scheme and salary is taxed well below the U.K. level.

Applications in the first place to Box No. 8077, Electrical Times.

(S 603)

GPO

A FIRST-CLASS JOB IN THE G.P.O

Men between the ages of 20—35 are required to work in Central London on installing and maintaining telephone apparatus and transmission equipment. Older men, up to the age of 45, will be accepted if they have the experience which is particularly suitable.

Commencing pay is £9 16s per week rising to £12 2s.

Men who show ability to progress will be given every opportunity to qualify for Technical Officer posts on which the salary is £600 a year rising to £850. Further promotion is available.

Apply in writing stating age and experience to:

Chief Regional Engineer (Ref. S/D2A(X2)), London Telecommunications Region, Waterloo Bridge House, Waterloo Road, London, S.E.1. (S 551)

SENIOR EXPORT SALES CLERK required by manufacturers of electric wire and cable. Knowledge and experience of export procedure in the electric cable industry essential. Duties will embrace handling of inquiries both written and telephonic, quotations and correspondence. Good salary and conditions for the right applicant. Apply: Sterling Cable Co. Ltd., Aldermaston, Berkshire. Tel.: Reading Trunk Sub 1000 P.B.X. (S 541)

ELECTRICAL DRAUGHTSMAN

AN EXPERIENCED ELECTRICAL DRAUGHTSMAN is required for the Central Engineering and Planning Department, Pilkington Brothers Ltd., to work with the Electrical Project Engineer on layouts and circuitry of major heavy electrical engineering installations.

Applicants, who should have had previous experience, will be required to design circuits under the supervision of a Chartered Electrical Engineer and to check contractors' work from time to time.

Applications should be addressed to Mr W. B. ROXBURGH, Group Chief Engineer, Pilkington Brothers Ltd., St. Helens, Lancashire. (S 507)

TECHNICIAN required for Psychology Department. Experience of electrical work and instrument maintenance necessary. Salary on scale £520/£720 per annum, but an older applicant, particularly well qualified might be appointed to a higher grade. Good holidays and working conditions; pension scheme. Send full particulars to the Assistant Secretary, Birkbeck College (University of London), Malet St, W.C.1. (S 573)

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A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co. Ltd., Stanmore, Middx. (S 2)

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and
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(S 27)

FOR SALE

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton, Elmbridge 2234/5/6. (S 9)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (S 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey (S 7)

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HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (S 8)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject.—F. W. Blanshard Ltd. (Dept. E.T.). Purley, Surrey. Uplands 4818/9. (S 6)

SECOND-HAND electrical plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Park, Middx. Telephone: Wembley 3121; Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (S 10)

2 "LEESONA" MULTIWINDERS, Model 104, 10 coils automatic paper interleaving, can be seen working.—Allen Components Ltd., 38 Felsham Rd, S.W.15. Telephone: Putney 3032. (S 491)

PATENTS

THE proprietor of British Patent No. 758,138, entitled "Electric Discharge Rectifier System" offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 140 So. Dearborn St, Chicago 3, Illinois, U.S.A. (S 521)

THE proprietor of British Patent No. 753,151, entitled "Electrical Terminal Clip," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 140 So. Dearborn St, Chicago 3, Illinois, U.S.A. (S 522)

THE proprietor of British Patent No. 626,068, entitled "Improvements in or Relating to Automatically Controlled electrical pumping units," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 140 So. Dearborn St, Chicago 3, Illinois, U.S.A. (S 520)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (S 1)

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GUARANTEED COACHING for CITY AND GUILDS EXAMINATIONS—Electrical Engineering Practice; Electrical Installation Work and Illumination Engineering. Also many practical non-examination courses. No books to buy. Write for FREE Prospectus, stating subject, to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. (S 13)

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Consult us with confidence. Our technical staff will gladly study and advise on your particular requirements. Our inspection organisation is fully A.I.D. and A.R.B. approved.

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INDEX TO ADVERTISERS

Allen, John, & Sons (Oxford) Ltd. ... 44
Arrow Electric Switches Ltd. 37
Associated Electrical Industries Ltd. (Cable Division) 48
Associated Electrical Industries Ltd. (Heavy Plant Division) 16
Associated Electrical Industries Ltd. (Motor and Control Gear Division) 65
Associated Electrical Industries Ltd. (Turbine Generator Division) ... 52
Automat (Electro Automat) Ltd. ... 18

Babcock & Wilcox Ltd. 23
Backer Electric Co. Ltd. 1
Bertram Thomas (Engineers) Ltd. ... 24
Bill Switchgear Ltd. 3
Bray, George, Ltd. 30, 31
British Driver-Harris Co. Ltd. ... 29
British Insulated Callender's Cables Ltd. ... ... *Cover* (i), 34, 73
British Klockner Switchgear Ltd. ... 6
British Oxygen Co. Ltd., The 39
Brown, N. C., Ltd. 74
Brush Electrical Engineering Co. Ltd. 20
Burn, George, Ltd. 74

Carridine & Miles, Ltd. 68
Channel Conduits Ltd. 49
Clarkson Brooke Ltd. 24

Dennis, G. P., Ltd. 28
Diamond H Switches Ltd. 38
Downes & Davies Ltd. 68

East London Mica Works 78
Electrical Apparatus Co. Ltd. 17
Electrical Times Ltd. 64, 66, 78
Electric Construction Co. Ltd. *Cover* (ii)
Elkay Electrical Mfg. Co. Ltd. 74
Ellison, George, Ltd. 46
Enfield Standard Power Cables Ltd. ... 67
English Electric Co. Ltd. 35
Erskine Heap & Co. Ltd. 45

Ferranti Ltd. 10, 11
Fuller Electric Ltd. 75

General Electric Co. Ltd. 27
Gent & Co. Ltd. 7
Greening, N., & Sons Ltd. 40
Grelco Ltd. 36

Hackbridge & Hewittic Electric Co. Ltd. 53
Harboro Rubber Co. Ltd. 63
Hirst Electronic Ltd. 13

Injection Moulders Ltd. 36
International Combustion Ltd. ... 26
International Synthetic Rubber Co. Ltd. 41

Kitson's Insulations Ltd. 36

London Electric Wire & Smiths Ltd. ... 77
Lumitron Ltd. 44

Martindale Electric Co. Ltd. 40
Marryat & Place Ltd. 6
M.C.B. Co. (Manchester) Ltd. 72
Metalastik Ltd. 51
Metway Electrical Industries Ltd. 18, 68
M.K. Electric Ltd. 8
Morley's Electrical Services (Holloway) Ltd. 42
M.T.E. Control Gear Ltd. 42, 68, 72, 74, 78

Nalder Bros. & Thompson Ltd. ... 13
Nettle Accessories Ltd. 72

Oldham & Son 49
Otter Controls Ltd. 39

P. & B Engineering Ltd. 66
Pascall Engineering Co. Ltd. 72
Philips Electrical Ltd. 5
Pirelli-General Cable Works Ltd. *Cover* (iv)
Pitman, Sir Isaac, & Sons Ltd. 76
Press, Wm., & Son Ltd. 80

Ratcliff, F. S., (Rochdale) Ltd. 18
Reyrolle, A., & Co. Ltd. 9

Sangamo Weston Ltd. 54
Shell Mex & B.P. Ltd. 14, 15
Simon-Carves Ltd. 32, 33
Spencer Wire Co. Ltd. 4
Square D Ltd. 12
Statter, J. G., & Co. Ltd. 76
Sterling Varnish Co. Ltd. 69
Streamline Filters Ltd. 25
Sturdy Electric Co. Ltd. 49

Taylor Tunnicliff & Co. Ltd. 19
Texas Instruments Ltd. ... ... *Cover* (iii)

Unity Heating Ltd. 76

V.G. Porcelain Co. Ltd. 78
Volex Electrical Products Ltd. 79

Wade, G., & Son Ltd. 71
Wallacetown Engineering Co. Ltd. ... 2
Wandleside Cable Works Ltd. ... 50
Westinghouse Brake & Signal Co. Ltd. 70
Whiteley, B. S. & W., Ltd. 43
Wootton & Co. Ltd. 76

Zenith Electric Co. Ltd. 4

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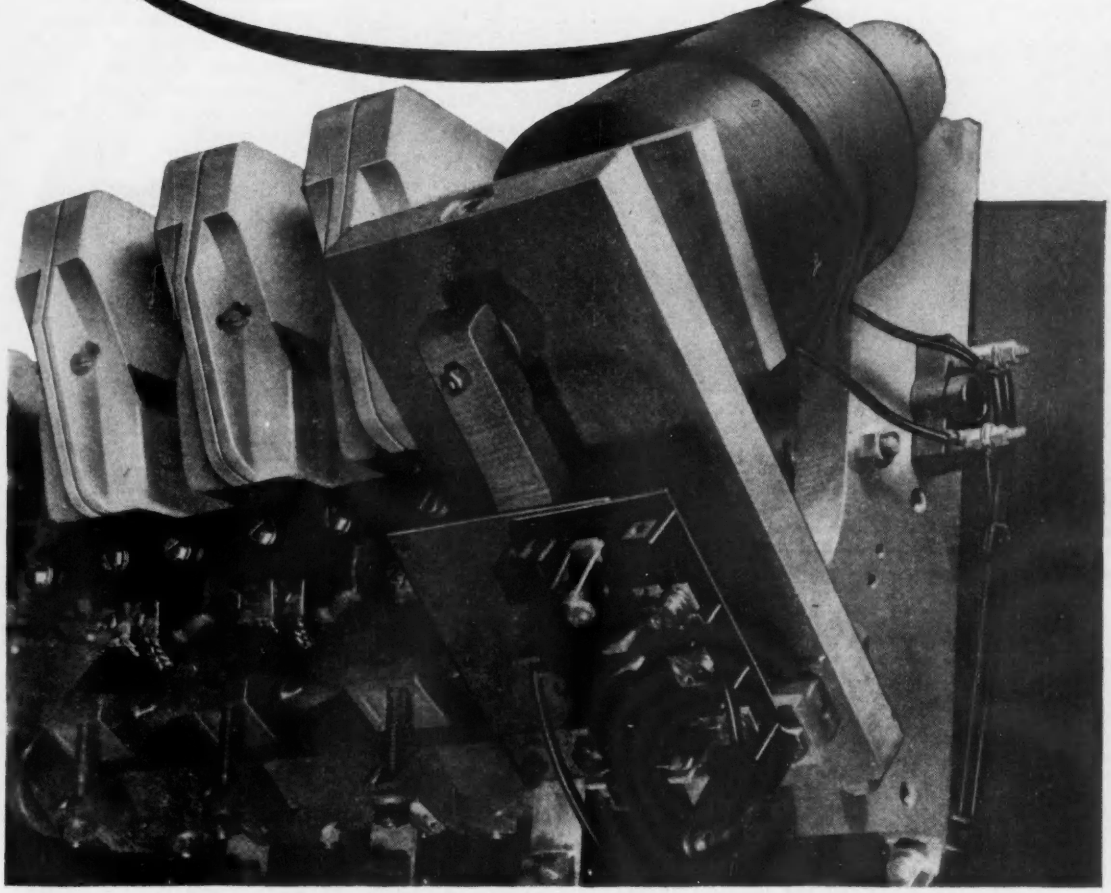

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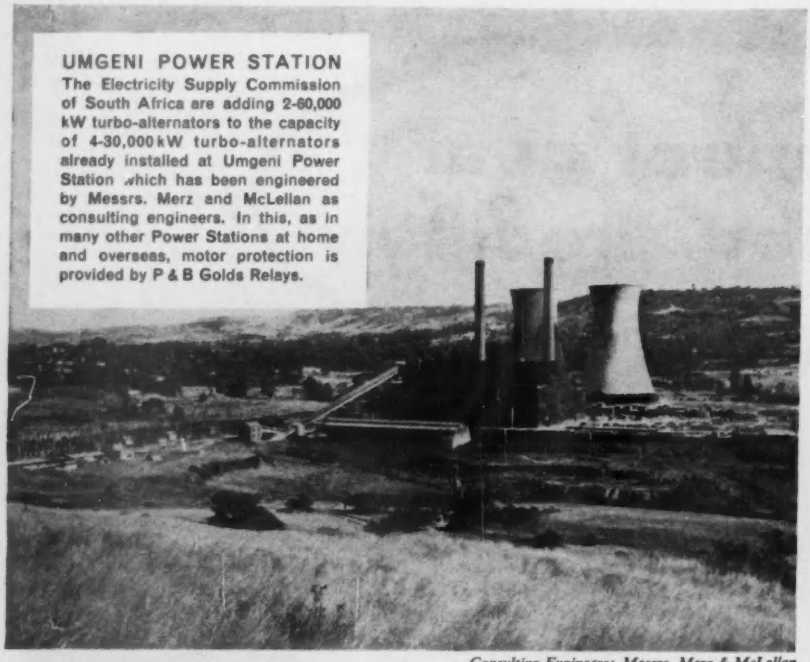

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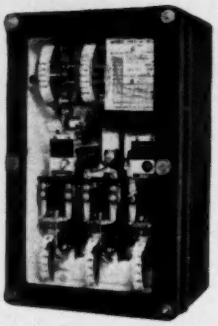

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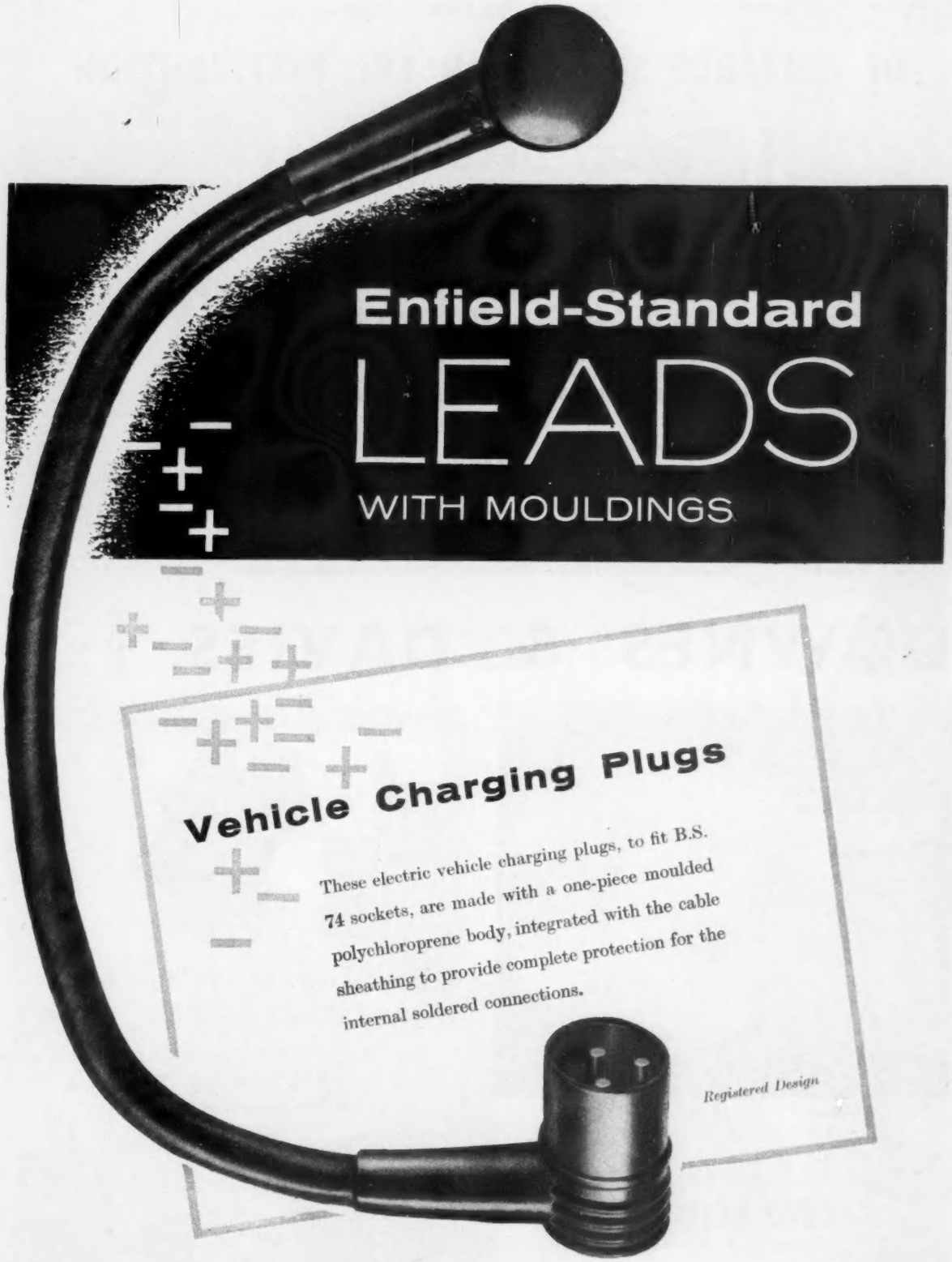

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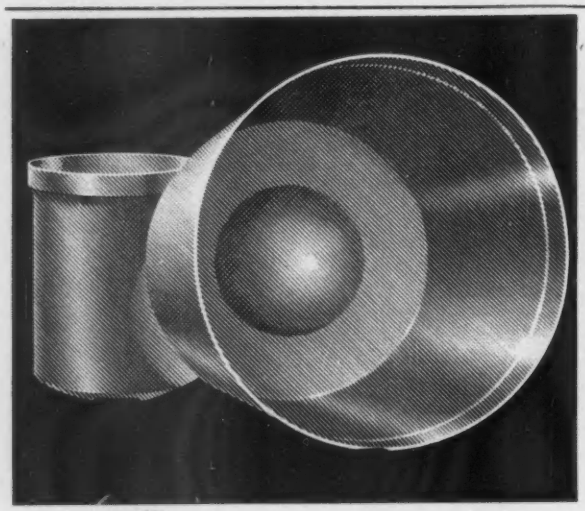

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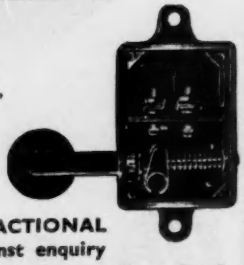

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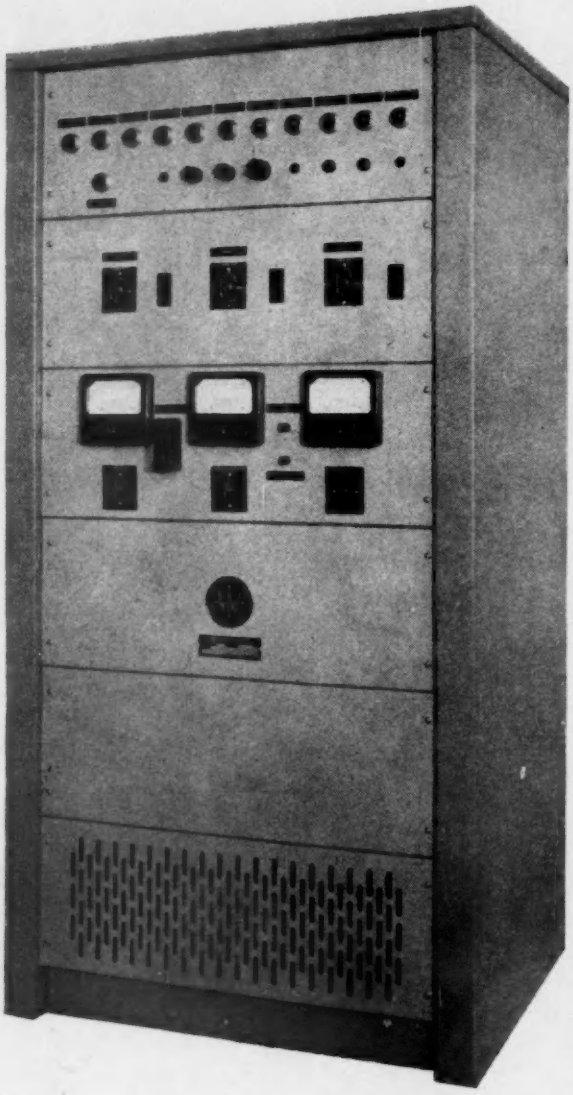

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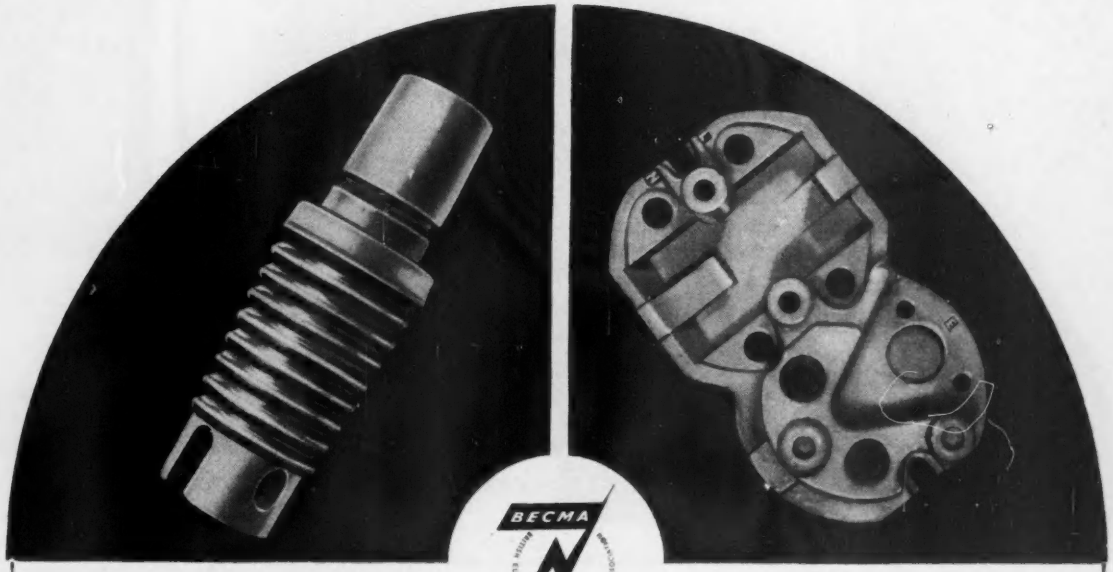

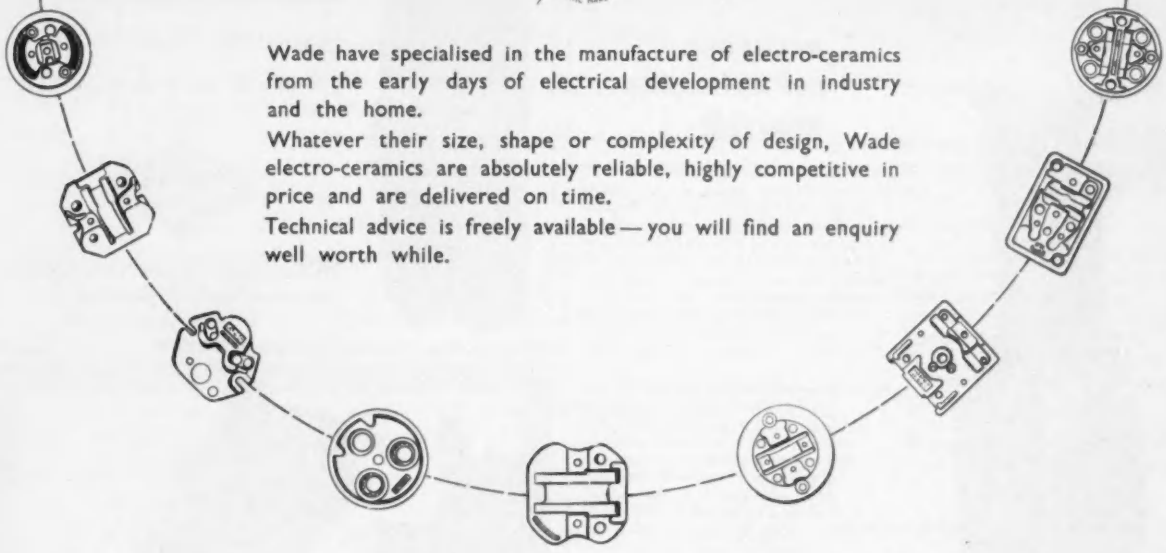

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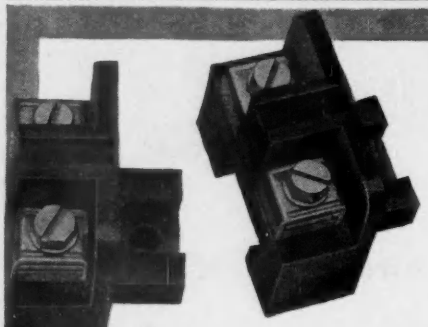

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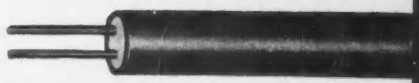

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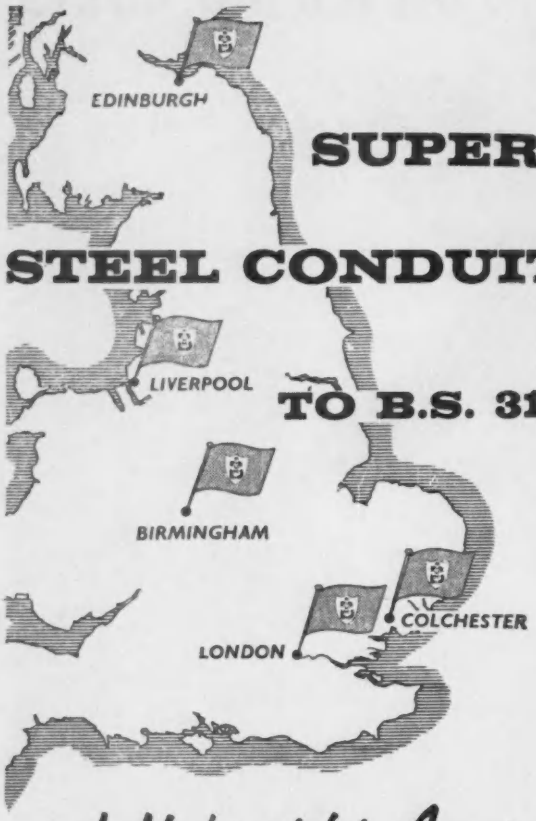

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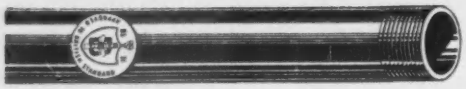

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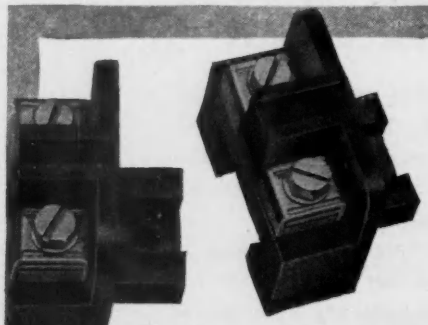

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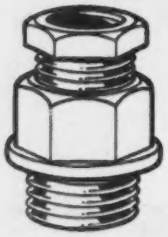

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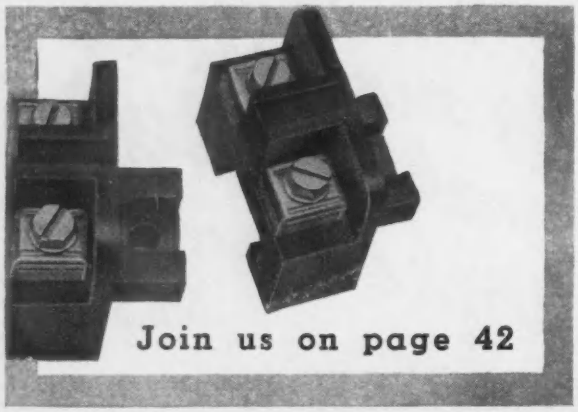

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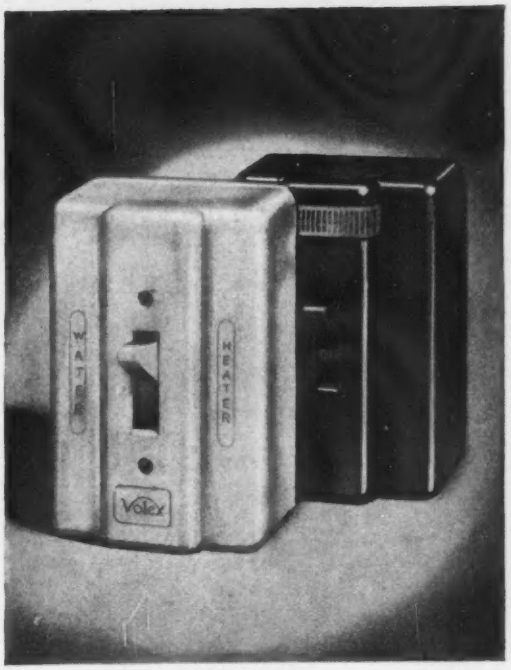

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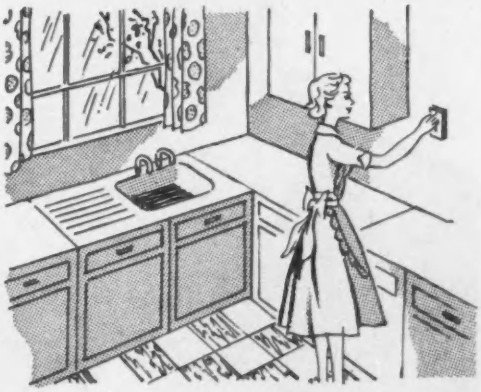

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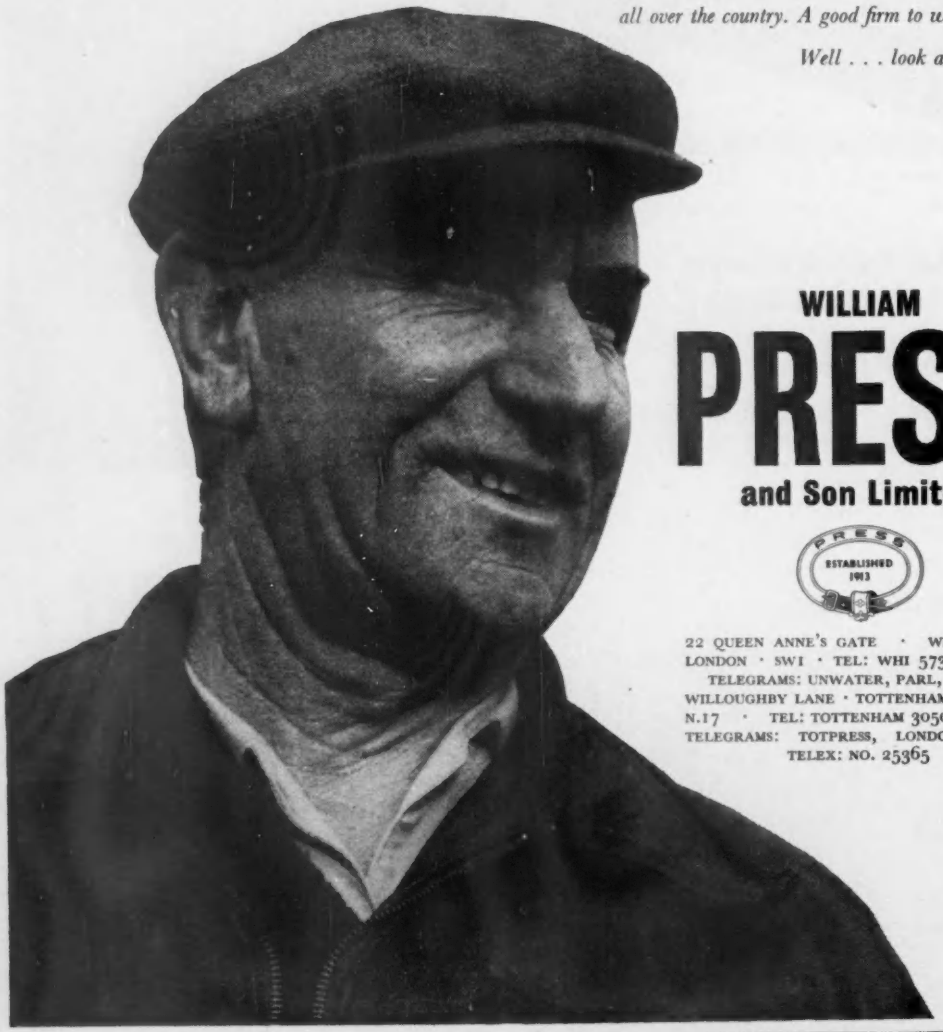

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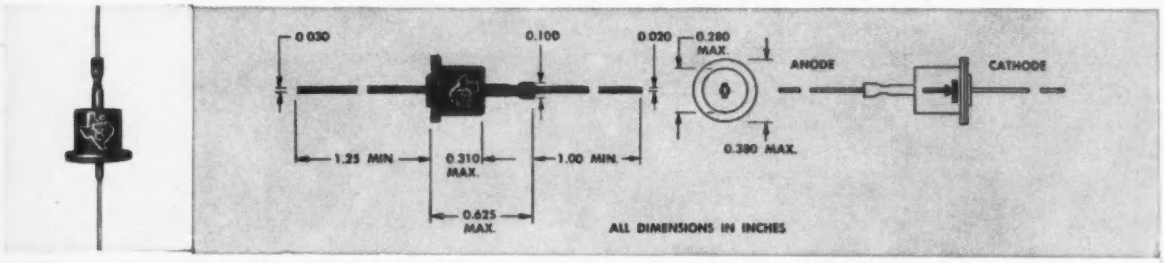

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